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HANDBOOK

FOR

Carpet Measurers, Cutters and Salesmen

INCLUDING

TOPICS OF GENERAL INTEREST TO THE TRADE

WITH ILLUSTRATIONS AND DIAGRAMS

BY

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PREFACE.

Although intended as a guide to Carpet Measurers, especially for those who lack experience, the information and hints contained in the following pages are likely to be of benefit to carpet cutters, layers, salesmen, and others connected with the house-furnishing business.

For those who have been long doing this work, claiming experience, it is a matter of importance to have a system and know just what measurements would be superfluous, how to do the work in the quickest and surest manner—in a word, to become thoroughly versed in their calling. Many of the rules and problems given here are the outcome of a long experience aided by a previous training in drawing and surveying.

Years ago it used to be the custom to cut and fit carpets at the house and then return them to the store to be sewed. Some of the large New York stores often take two hundred orders for carpets in a single day. Manifestly it would be impossible to do work in the old way. Now, however, the room or spaces to be carpeted, literally speaking, are brought to the cutter at the store by the measurer, who, if he understands his business, so measures the most irregular room or space that it can be reproduced with perfect accuracy when struck out on the cutting floor of the carpet workroom.

It is the aim of the writer to show how this can be done, using the most practical methods.

The diagrams are not only typical but actual examples, and from them one can get an idea of the complexities met with in modern houses.

Though a general understanding of mensuration and plane geometry is recommended, the possession of this knowledge is not essential. There are several problems, however, which every carpet measurer should be able to solve, and to become competent, something more than rudiments should be known. The most important and useful of these problems are explained and will be referred to as occasion demands.

To err is human. Nevertheless, none of us like to make mistakes, and, what is more, we ought constantly to guard against them by checks of various kinds. Mistakes on the part of the carpet measurer or cutter are especially costly, and a man's value to his employers is usually determined largely by his accuracy.

It is hoped that careful perusal of the following pages will insure to the benefit even of those who only occasionally make such mistakes, and do a service by helping to reduce these to a minimum.

CONTENTS

PART VI

PART VII

PART VIII

PART IX

PART X

PART XI

PART XII

PART XIII

INTRODUCTION

The difference in the amount of work handled by the carpet trade in the dull and busy season is so great, it is extremely difficult to have available at all times sufficient skilled help.

It is, therefore, frequently necessary to call on men in the business, not familiar with the mechanical part of the trade, to help out the workroom force. The result, as may be expected, is misfit carpets. These mistakes, coming as they do in the busy season, disarrange so to speak the smooth running of the machinery, and are consequently both costly and annoying.

To eliminate as far as possible such mistakes, and assist those with limited experience, has been the main object in publishing this book. It has been written by a man thoroughly experienced, and the work explained in a practical manner, making it possible for the student in a few hours to gain knowledge which otherwise would take years to acquire.

Recognizing its value, I heartily recommend this book to the carpet trade.

George Lyndoe.

PART I

IMPLEMENTS OF THE CARPET MEASURER

THE TAPELINE

A fifty-foot tape is the length best fitted for the work of carpet measuring, and one of the best standard makes only should be used. As, however, even these will vary in time, and as we remember that the line used by the measurer is not the one used by the cutter, it will be seen how important it is to compare the two frequently, or, better still, to test them by a steel tape or some measured distance laid out on the floor, say twenty-five feet in length, and marked every 12 inches with fine brass screws, the slots of which mark the feet. This will always be available to the cutter and measurer alike, and when several lines are in use those found incorrect should be discarded, as it is cheaper to buy a new line than to replace a misfit carpet. It will be found convenient to have a few holes punched in the line and small eyelets inserted, say at the 1, 3, 6, and 21-foot marks.

THE RULE

The rule is used chiefly as a straight edge for drawing the plan, for measuring under furniture or in other places where use of the tapeline is impracticable. When line

and rule are used in combination care should be taken to add the length of the rule to the readings on the line. To avoid the error of this omission it is best to bring the mark on the line corresponding to the length of the rule up to the end of the latter, and then fasten it, then pick up the rule, which also diminishes the chances of leaving it behind. The eyelets mentioned above will prove useful for inserting the awl at one of these points as a safeguard against injuring the tape. A rule made with a beveled edge having a 1-4 and 1-2 inch scale will be found convenient, especially when measuring from architects' plans or drawing to a scale.

THE AWL

This instrument is used to fasten the end of the tape-line to the floor by inserting point through the small hole next the ring. It should have a fine removable point, which if broken can be renewed. A pocket awl made by C. Wood is a very practical tool for this work. It has a hood or socket made to slip over the awl point and so protects the person carrying it from injury. The hood also is used as a wrench when changing points. It is always at hand, as it is never removed from the main tool except for this purpose.

THE CHALK LINE

This may be any ordinary twisted or woven line; the finer it is the better as it makes a finer mark and takes up less room. In addition to these tools a pair of dividers will be found useful.

THE LEAD PENCIL

Pencils best adapted to drawing are black, Nos. 2 and 3, according to whether the paper is smooth or rough. The lead should be sharpened in the shape of a wedge, thus producing strength and durability and making an even black line. Black, No. 3, sharpened round is best for writing in the figures.

PART II

DRAWING THE PLAN

On entering the room to be measured, take an eye survey, noting the relative size of the sides. If there are two or more adjoining rooms observe whether the walls are in the same straight line, or whether the walls in one room project beyond those of the others, also if doors have sills or not, or if sliding whether rod is at the top or bottom. Then begin in the room nearest the front, using, if no other means are at hand, the wall or floor as a drawing board, making front of plan at top of paper, and draw the outlines of the room as near to scale as possible. Draw all projections and recesses, show slants and curves of sides, if any. Mark plan at windows with a "W," doors with a "D," entrance with an "E." Note if there is a fireplace and whether open or not. If measuring for rugs, it is also necessary to note registers and radiators, their exact size and distance from walls. Pass to the next room and proceed as before. If adjoining, draw it the thickness of the wall from the first, draw closets if any, in short, reproduce on paper the floor of each room as it appears and in proper location with reference to each other, thus making a complete ground plan of the whole. In taking a diagram of any large house, such as an apartment house or hotel, where the rooms over the ones below are about the same shape and size, it will save time

by having a sheet of paper for each floor placed one over the other, then by bearing hard on the pencil each underlying paper will have traced upon it the plan, which only needs going over with pencil to finish. When measuring theaters, churches, or boats, where curves, projections, and recesses predominate, it is advisable to draw the plan to scale. This can be done by first measuring the place, marking the figures on the floor, afterwards drawing the plan from these figures, using any convenient scale as 1-4 or 1-2 inch to the foot, or else drawing each line to scale as fast as measured. (Avoid copying plans, as mistakes are apt to follow.) It will take a little more time, but you will be repaid by being certain that your plans are correct, for if any measures are wrong the plan will not prove. It is also less difficult to cut, or figure from such a plan, and the breadths can be laid out or estimates given with great exactness. When a plan is to be made of several adjoining rooms, some of which may be dark or with rough walls, begin by making a light freehand sketch of each room, after which a smooth surface where the light is good can be selected to finish the plan. If all lines running in the same direction are drawn before turning the paper to draw the others, an advantage will be gained in speed.

After the plan is drawn, which should be done with even, black, heavy lines, draw fine light lines to represent other measures which are to be taken, such as angles, or cross, and square measures, etc. This diagram will give something tangible to work from at the start.

If part of the floor space is to be covered by a rug and the rest with filling, or if it has been arranged to run the

border any particular way, this should be shown on the plan by sketch and figures, and then submitted to customer for approval. Moreover, if any instructions are given by customer or suggestions advanced by measurer and accepted by the former, such directions should be written on the plan and repeated to the customer before leaving the house. The importance of this part of a measurer's work cannot be emphasized too strongly, as failure to do it, or an attempt at committing to memory such instructions, will eventually cause trouble. When it is required to measure for cocoa or rubber mats, which, on account of irregularity of shape, have to be made to order, a paper pattern should be taken and sent to the factory, and a copy of same kept at the store. Do not forget to mark the top of the pattern.

PART III

SUGGESTIONS TO MEASURERS

The first aim of the prospective carpet measurer should be accuracy. To attain this, all his work should be done with the greatest possible exactness. Measure all rooms so that they can be reproduced, or "struck out." Measures should be taken to an eighth of an inch when carpets are to be bordered, but even when plain, close measures will often assist the cutter in the difficult task of covering a space with barely enough goods. Negligence in this respect at the start is apt to foster habitual carelessness later on. If a customer resides far from the store, or measures are taken before the carpet is selected, border measures should invariably be taken. Make it a point to take such measures only as will bring the best results, and do not fill the plan with a lot of unnecessary measures, taken in a haphazard way, that prove nothing. On the other hand, no measures should be omitted that will serve to check the work. It is far better to have too many measures than not enough. Make a close study of the different methods of measuring given in the following pages, and apply them in drawing imaginary floor spaces, or copy the several diagrams given, using rule and dividers. Proficiency and self-reliance will be the immediate result. Never waste time figuring out where you can stop

a breadth or put in a piece, as you will then inte with the work of the cutter. Instead give him the curate measures and the exact shape of the floor. are the architect of the business, the cutter is the build he knows what material he has to work with, while you not, therefore give the proper instructions and leave the rest to him.

The difference between measuring for bordered and plain carpets will now be shown.

For a border carpet all the wall lines, together with diagonal, or square measures, should be taken in order to assure a perfect fit. In a plain carpet all the waste is left on, to be turned under or cut off by the carpet layer. It is, therefore, unnecessary to give as many measures as when carpet is to fit exactly. The measures given should, nevertheless, be exact and so taken that any slant of the sides can be determined by the cutter. Thus in a rectangular room length and width only are necessary; in a room of trapezoidic shape, Fig. 1, Part VIII, length of the parallel sides and the perpendicular distance between them are given. On a floor like a trapezium, Fig. 3, Part VIII, the greatest length, length of the sides to which this line is parallel, the perpendicular distance between them, together with the greatest width, are taken. And in general such measures are taken as will divide the floor into the necessary number of triangles and trapezoids, Fig. 4, Part VIII. The measures given in these figures are all that are necessary for plain work or estimates, and it will be noticed that, although all wall lines are not measured, they can, nevertheless, be struck out if required. It is, of course, understood that, whether

plain or bordered, all recesses should be taken. In the busy season in large cities, where measurers often are expected to take from twenty to forty orders a day, several minutes may be saved in each house, in the case of a plain carpet, by taking only such measures as are necessary for plain work. Cutters, however, should not attempt to cut borders from plain measures, since if an order is changed the room can easily be remeasured. If more rooms are measured than the order calls for, give the reasons for taking them, whether for selection, additional order, etc., plainly written in each diagram or elsewhere on the plan.

As many cutters find it convenient to strike out the plan, working from straight lines marked on the floor, perpendicular or at right angles to each other, it will be of aid if measures are taken from similar base lines. Several methods of how to erect or let fall perpendicular lines are explained in this book, and the measurer can use the one he finds most convenient. Measurers, however, should never rely entirely on what is known as square measures, but use cross measures also to check their work. A plan of any room can be reproduced if measures are taken on any known line of perpendicular offsets to corners or projections without measuring the walls at all. These offsets when connected by straight or curved lines, as the case may be, form the true wall lines, but a single wrong measure which a cross measure would check, might not be detected until too late.

No matter how used to any particular system a cutter may be, he never fails to appreciate the value of cross or diagonal measures.

After the plan is drawn, begin at the entrance side of the room to measure. If this side is not straight make it such by snapping chalk line on the floor parallel, or at right angles, as the case may require, Diag. 38, to the direction in which the breadths according to the measurer's judgment or customer's dictation should run. From this chalk line as a base, measure both ways across the room, also the whole width for a check. Now fasten the end of the tapeline at the rear end of the room and measure, in the direction the breadths are to run, the length from end to end along wall or chalk line. Pull the tapeline sufficiently taut to take out any kinks it may contain, then pass along and note the reading, recording them on diagram. Read figures on tape again, and glance at the preceding figures to avoid making the common error of taking six for nine or vice versa. If any recesses or projections occur along the line, note down the figures on the tape opposite each, Diag. 5. After releasing the tape, use it to measure depths and length of recesses before proceeding further, or if depth of recess is not greater than the length of your rule use this, in which case the depth should be taken when the recess is located. If the entrance side is not a straight line, and there are more than four sides to the room all running in different directions, snap two chalk lines on the floor perpendicular to each other, if possible, and as long as they can be, Diags. 38 and 45, then, by measuring these lines and noting the point of intersection, two base lines are established from which all other measures may be taken. It is not necessary that these base lines should be at right angles, but if not the angle or slant they make with each other should be ascer-

tained by measures from line to line between any two known points, Diags. 38, 45, and 5. If the room is too large or obstacles exist preventing measures being taken from two base lines, Diags. 4 and 5, strike out with the chalk line a four-sided figure as large as possible and from the four sides, as base lines, take the necessary offsets. Theaters, churches, boats, and lodge rooms should be measured from the center in both directions, and the whole width also should be taken to check the work.

When measures are taken of circular, or, as they are more commonly called, swell windows, Diags. 34 to 44. the measurer should first ascertain whether it is a segment; i. e., a part of a circle, or a part of an ellipse, Diag. 41, or any other conic section, Diag. 45. To do this, try and find the center by any of the methods given in this book. The distance from this point to any part of the swell is called the radius, and should always be given on the plan together with the height or longest perpendicular distance from the chord, or opening of the swell, to the wall. The two measures combined will always check the work, whereas, if the radius only is given, or the cutter is left to find it from measures given of the height alone, or distance from center to chord, any errors in these measurements will cause corresponding error in length of the circumference or swell without being discovered. If after trial no such center can be found, then the swell is no part of the circle and perpendicular offsets must be taken from one or more measured straight lines drawn from a common point or points on the circumference, across it, or to points of opening of swell, or both (see Diags. 37, 41, and 45). Again, the depth of the swell may

be so shallow that the center would be far back in the room, Diags. 37 and 38. In this case it will save time to snap a chalk line across the swell, lay the tape over it and measure offsets at right angles to it, with the rule or tape, 6 or 12 inches apart, Diag. 37. The cutter can then produce the swell by finding the radius, the different offsets serving as a check, or he can lay out the offsets and with a flexible rod or thin strip of wood and chalk connect the ends of the offsets.

It may happen sometimes that the walls are so obstructed with furniture, that to get accurate measures would necessitate disturbing the latter with the risk of damage to wall or furnishings, removal of the latter causing annoyance to customer or wasting too much time. Cases of this kind are not frequent, but, nevertheless, happen, and as a measurer ought to be prepared for any emergency, Diags. 7 and 8 can be studied to advantage.

In Diag. 7, the furniture, i. e., a what-not, dresser, and bookcase, happened to be so arranged that it was impossible to get at the walls, and as the lady expected company she was unwilling to have anything moved. On investigation, however, it was found that the corners were accessible by placing the rule under the furniture. Measures were taken as in Diag. 7, and the carpet, which was a bordered Wilton, cut and made and when laid proved a perfect fit. The lady, who in the meantime had been greatly worried, as she felt partly responsible for not allowing the furniture to be moved, was very much pleased with the carpet, and after that had great faith in the ability of the workmen of that store.

Often a man is sent to measure a house only partly

finished, perhaps with only the studdings up, and in such cases only approximate measures should be taken, in order that sufficient goods may be reserved or estimates given. Of course, border measures should not be attempted, as alterations in construction of rooms would result in a misfit carpet, and the measurer would have no excuse, as he had no right to turn in a diagram based on guesswork.

The measurer is often called upon to give an estimate of the number of yards required, or the cost of the carpet. Although it is preferable not to volunteer giving estimates, it is sometimes difficult to refuse a customer's request, especially when the goods are to be sent C. O. D., as the customer may desire to know approximately the amount of money to have on hand. When there is competition for the order or the customer is in no hurry to have the carpet delivered, the figures given may be the means of holding or losing the order.

The measurer, therefore, should be able to give estimates, but always with the explanation that they are only approximate, as he has no way of knowing what loss there would be in matching the figure. It is taken for granted that the measurer is acquainted with the common rules of arithmetic, otherwise, the examples given in this book will be a great help. The estimate should always be written on the plan for future reference. It is customary to figure the yards net and then add from one foot to half a yard for each breadth; it is better to figure liberally as the measurer then will be on the safe side.

The measurer should always endeavor to write small plain figures. In the diagrams they should be placed in

a continuous line and as nearly opposite the point measured as possible. Remember also to name or designate each room or space measured, that the layer may have no difficulty in locating the same. Moreover, try to do your work in such manner that it will be easily understood by all who shall have occasion to refer to the diagrams.

PART IV

PRACTICAL HINTS ON MEASURING

HALL MEASURES

In measuring front halls, begin at the entrance, as the carpet is usually rolled toward the rear in cutting. For the same reason all halls above the first ought to be measured from rear to front. Position of the stair should always be shown, to prevent cross-joins being placed where most conspicuous. All door recesses, however slight, should be given, because it may save waste of material and unnecessary labor for the carpet layer.

HALL TRACKERS

To give the best effect a tracker should be placed in the center of the hall, but as it is not always desirable to have it cut to conform to the shape of the hall it is well to measure the entire floor, and then show by sketch and proper figures the position of tracker on the plan (see diagram of halls).

TO MEASURE A STAIR

Begin at the top and measure down across tread and over risers, and then to check the measurements and ascertain number of pads wanted, count the number of steps. If all the straight treads are of the same depth,

the length of one step (tread and riser) multiplied by the number of steps will give the length of carpet provided the stair is straight. If winding add six feet for a four-feet or under square landing, or, if no landing, three feet for each turn,—if the stair is in several parts, and divided by landings, measure each section separate (see diagram of stair). If the stair itself is winding, begin at the top and run the tape down next the baseboard to the beginning of the first winding tread, then across the corner of the wind to the nosing of the next straight tread, in such manner that the distance of the tape from the baluster will be equal to the width of the straight step, then down to the bottom. If the stair is to be covered entire, measure the width of the straight step, and the perpendicular distance from the tape to the corner of the wind—also note the readings on the tape at the two points from which the line crosses the corner. If the steps vary in width, let tape remain, and with an extra line or rule measure across the steps as they increase or diminish in width and note the position of each cross-measure so taken on the long tape (see diagram of stair). Always give the exact length of the stair and let the cutter add allowance for slipping. There is no more reason for the measurer to add to this measure than there is for him to add to any other measure taken in the house. The only time this allowance should be considered by him is when giving estimates, and then the length of one step is to be added to each breadth. It is as well, however, to have an understanding with the cutter on this point, as it is the custom in some stores for the measurer to add this allowance, while in others again it is left to the cutter.

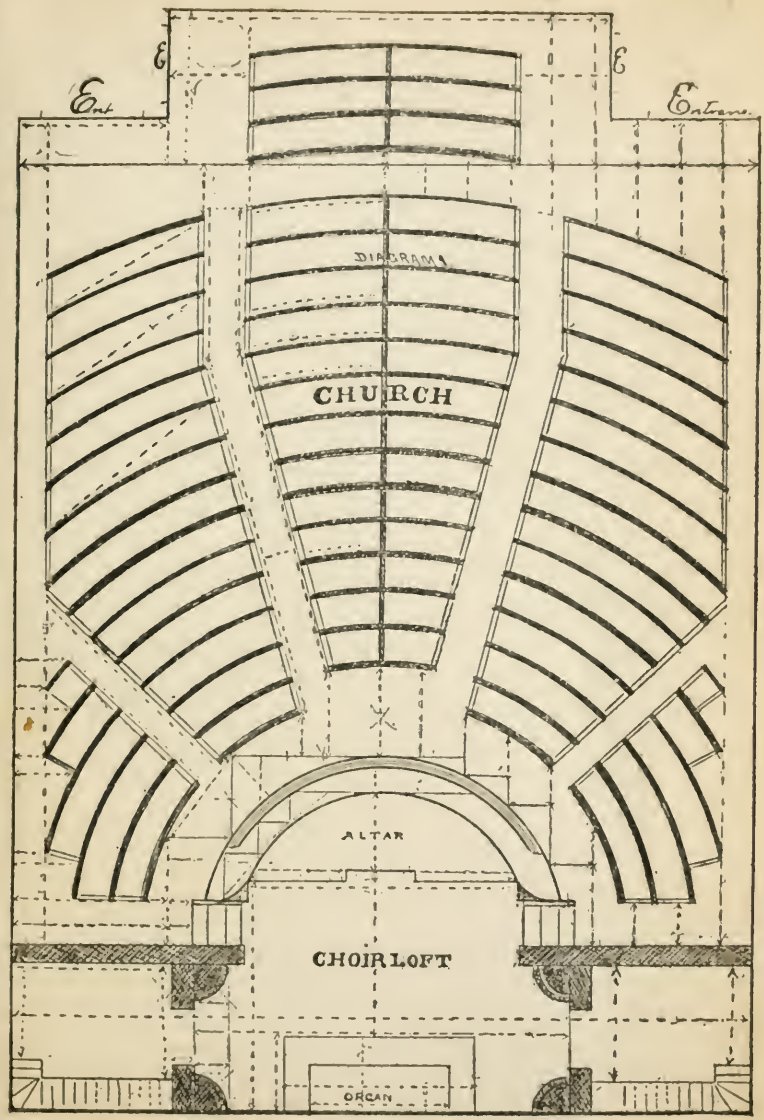


DIAGRAM 1.

TO MEASURE A CHURCH LIKE DIAGRAM 1

Find center line of room. If possible snap chalk line across it from wall to wall, if not, as far as it will go. Measure on this line, beginning at the center, on one side mark off every 27 inches, on the other every 36 inches, or, if width of carpet is known, lay off the breadths on one side, and on the other offset marks to corners, aisles, and pews; measure such breadths or offsets from marks on chalk line both ways. If pews intervene, as in front of altar, snap chalk line perpendicular to center line as far as it will go, from ends set other perpendicular lines and so on until a straight line will clear the circumference of inner circles, measure as before, laying off breadths on one side and offsets on the other, and always measure from line on which such marks are made. By proceeding thus the room can be struck out, or carpet cut direct from plan, and figures can be more readily perused, as the plan will not be crowded. In pews if one or both ends slant, measure the longest diagonal, if ends make the same angle with front or back of pew measure the longest side.

TO MEASURE A THEATER—DIAGRAM 2

After center of room is found, which in this plan is ascertained by finding middle of center door, or by measuring from door to door each side of the center door, or by lining up the posts, lay out center line CD and from the end, touching back of seats, snap chalk lines at right angles as far as possible in both directions, as AB. From the center, on this line, mark off breadths on one

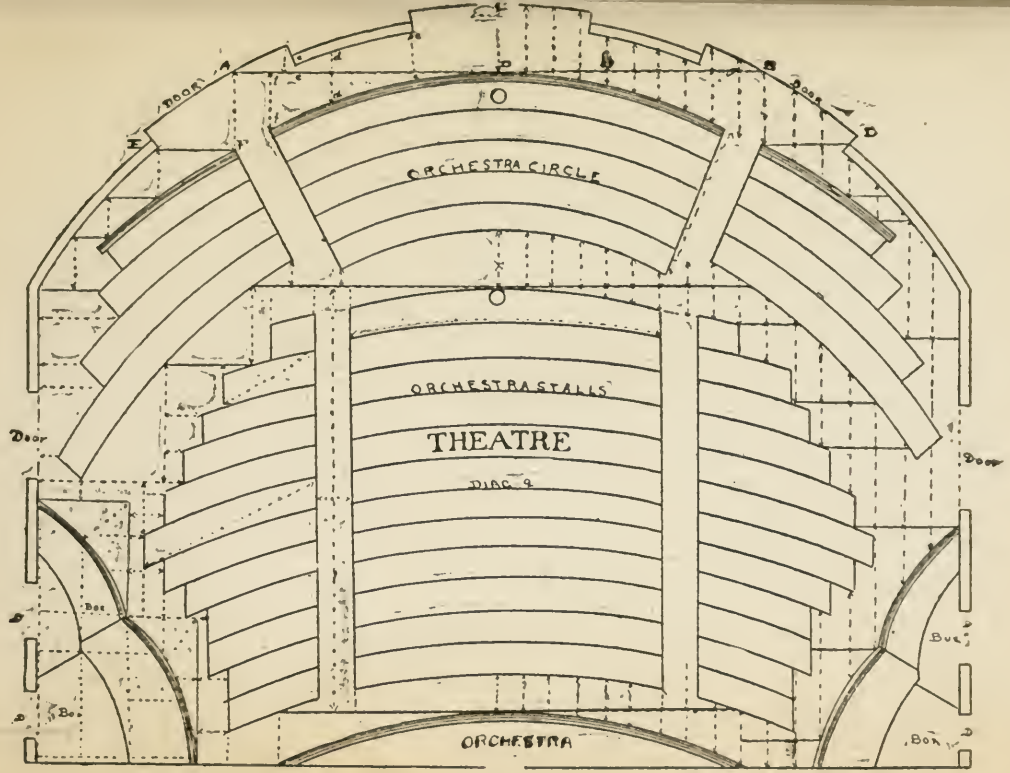

ORCHESTRA CIRCLE
ORCHESTRA STALLS
THEATRE
DIAG. 9
ORCHESTRA
Door
Door
Door
Box
Box
Box
Box

DIAGRAM 2.

side, and offsets to aisles and corners of seats, etc., on the other,—from end of the last breadth or offset draw other lines parallel to AB, and continue as before to end of line and again produce lines parallel to the last and so on, first back of orchestra circle, then back of orchestra stalls, and last in front of orchestra. Draw on your paper a line to represent the line AB, but extend it to the full width of the paper, bisect this line, from the center lay off all the breadths to scale, counting from the center line to wall. Through these marks draw, lightly, perpendicular lines parallel to each other the full length of paper. Now measure to the offset marks and lay these down on the paper according to scale. After all offset marks have been laid down draw light lines through these marks upon which set length of offsets, also to scale, measured from AB in both directions. Fold paper back on center line, connect offset ends, first lightly, then by bearing hard enough on the pencil to show trace on folded part of paper, straighten it out and go over tracing marks with pencil and the plan is complete. The length of breadths can be ascertained from scale and will be a check on your work. The breadths should now be measured from the chalk line both ways and recorded on the corresponding lines on the plan, also measure boxes from entrance side and wall; the work is now finished unless carpet is to go in front of seats, in which case measure each row and number same.

Note in this theater both sides of the house are alike, this is not always the case however, but if any difference exists it will easily be noticed before the plan is finished; when corrections can be made.

TO MEASURE A BOAT—DIAGRAM 3

Chalk line as long as possible fore and aft parallel to keel or center line of boat. On this line lay off marks for offsets to curved sides every two feet, also to corners of houses, stairs, radiators, gang-ways, and all stationary objects, working from aft forward. Measure distance of chalk line from center line and draw these two lines on paper, laying off the offset marks on the paper to scale, together with all measures taken of offsets and gang-ways. Fold paper back on center line, connect ends of offsets by straight or curved lines as the case may be. Bear hard enough on the pencil to mark folded part of paper, and proceed as in Diag. 2 to get a correct plan. Lay tapeline on the opposite side in the same position and at the same distance from the center as chalk line, and walk along it, comparing as you go the recorded measures with the tape. Number and measure all staterooms. For a check, lay rule on plan and measure length and width, which should correspond to the different measures taken for length and width. Observe the least conspicuous place for cross-joins, as the carpet for convenience in handling may have to be cut in several sections and the places for joining such sections should be located on the plan. Indicate also the forward and after part of the boat.

TO MEASURE A LARGE OBSTRUCTED SPACE—STORE PLAN, DIAGRAM 4

Chalk line from A to any point B so it will clear all obstructions, extend it to the wall if possible, from A to D extended, from D to C and wall. Thus making as large a four-sided figure as possible inside the counters. From

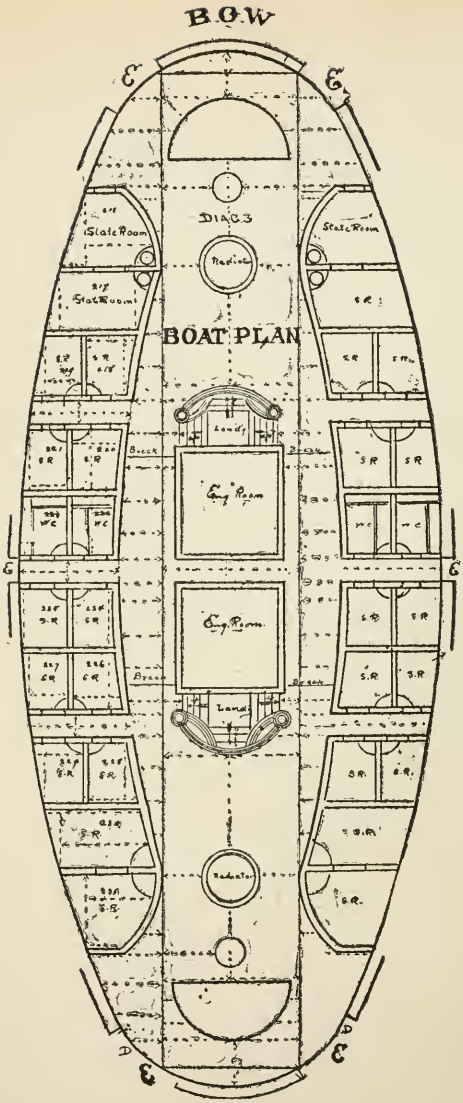

BOW
DIAG 3
BOAT PLAN
State Room
State Room
Eng. Room
Eng. Room
Radiator
Radiator
Laundry
Laundry
Bunks
Bunks
S.R.
W.C.

DIAGRAM 3.

A take cross measure to C, or to any other part of CD as far from D as possible. From these four chalk lines or

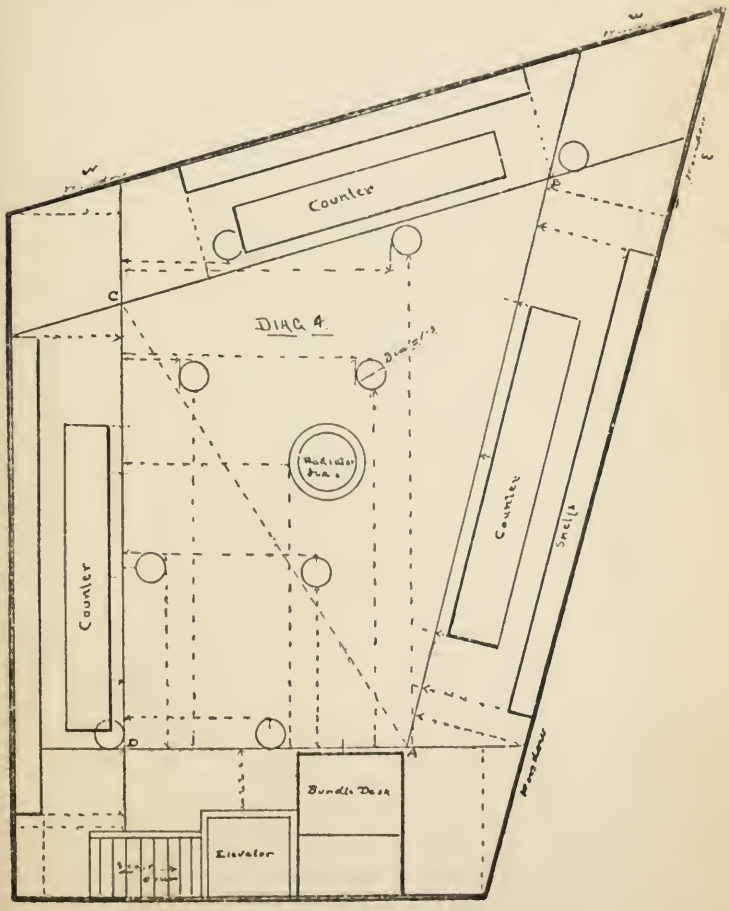


DIAGRAM 4.

extensions take offsets to walls, counters, and shelves. From CD and AD take measures to locate posts and radi-

ator; give diameters of same. Measure and record the chalk lines and the distances of the points from which the square measures are taken.

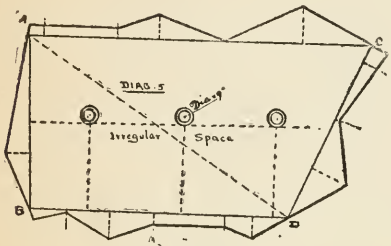


DIAGRAM 5.

HOW TO MEASURE IRREGULAR ROOMS—DIAGRAMS 5 AND 6

Almost any irregular space can be measured by these methods.

Lay out the space ABCD as large as possible, with chalk lines. Measure this space accurately, and determine the slant of its sides by cross measures. Then from the sides of this figure take offsets to the different corners. Locate the points on the chalk lines where the offsets are taken. Measure from lines AB and BD to posts, then all the wall lines.

DIAGRAM 6

Chalk lines from A to B and a, from B to b. From D to d and C, from C to c. On AB and DC select the points m, n, o, and p. Measure Am, An, AB, Aa, A2, A1, and Ac. Measure

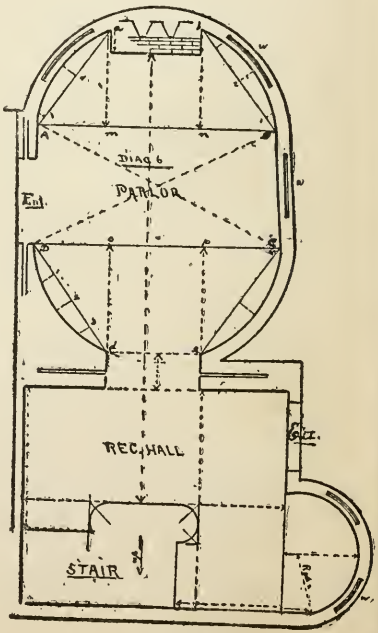


DIAGRAM 6.

Bb, B2, B1. Proceed in the same manner from D and C. Measure the offsets ma, nb, od, pc, all the short offsets, across the door, mantel, and depth of hearth, and thickness of walls at the doors, A, D and C, B.

To Measure a Window or Room the walls of which are inaccessible—Diagram 7.—On any convenient part of line AF draw a semicircle. Give radius of this circle, also the distance from center to the points A and F. Lay your rule or a straight narrow stick on the floor, push it up to the corner to be measured and let it remain. Fasten tape at the center of the circle, bring it over the rule or stick, move each to the right or left until the edges are parallel and in a continuous line. Now make a mark on the circumference at the further edge of the tape as a, b, c, d, e, f, proceed in like manner at each corner, adding length of rule or stick to measure on tape. Measure and record the straight length Ba, Bb, Bc, Ef, Ee, and Ed.

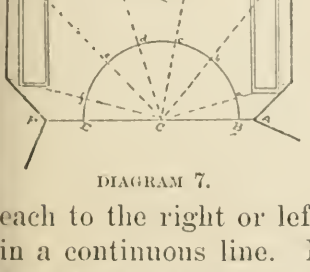


DIAGRAM 7.

To strike out this window.—From the given point C on AF, and with the given radius, describe the semicircle. From B and E, lay off the given measures Ba, Bb, etc. Fasten chalk line at center of circle, bring it over the different points on the circumference and snap it. Make these chalk lines the length previously taken to the corners. Connect the ends of the chalk lines.

If the corners are inaccessible or the space is a circular window or room—Diagram 8.—On the line AF, Diag. 8, erect a square with any convenient side, the longer the

better. With a long straight edge, or rule and tape, as in the preceding example, measure from wall across the square, marking the sides of the square where the straight edge or line crosses it. Measure and record the corners C and B, from A or F, also the length Bb, Bc, Bd, etc., etc.

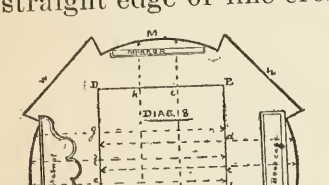


DIAGRAM 8.

TO CONSTRUCT

From the given point B or C, and with the given length of side, erect the square BCDE. From B, C, D, or E lay out the offset marks, from b and across CD at c snap chalk line continued. Proceed in like manner with the other offsets. On these chalk lines lay out the lengths as taken, connect with a pliable rod, or find radius as in Problem 7.

To Measure a Window where the true corners owing to moldings are inaccessible—Diagram 9.—Snap chalk line parallel to the wall lines and so that they will clear all projections, thus producing with the chalk line a space inside the true window; this space should now be measured as shown in the various diagrams, to determine the length and true directions of the sides. From the boundaries of this figure measure to the baseboards and into the recesses, which will give the true window.

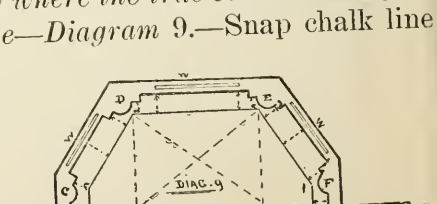


DIAGRAM 9.

How to Measure a Room or Rooms from the outside without entering a house.—It sometimes happens that the measurer when he arrives at the house he is to measure finds it closed, leaving him to choose between waiting an indefinite time or returning a second and perhaps a third time. If the order calls for a plain carpet or an estimate, and the room is so situated that the floor can be seen from the outside through the window, the length and width of the room can be ascertained near enough for all practical purposes by the following methods.

FIRST METHOD. SEE FIGURE 1

Measure out from the wall any distance, say one or two feet, record this distance, the thickness of the wall and the distance of your eye from the floor when standing erect. Now place yourself over the measured mark in such a manner that the further end of the floor can be seen. Assume an upright position so that a plumb line dropped from your eye will come directly over the mark. Next take your rule, place the outer edge of one-half against your face so that it will be plumb with the ground. Sight along the upper edge of the other half, moving it up or down on its hinge until the bottom of the baseboard or end of floor is seen in line with rule. Now place rule flat on the paper, taking care not to change the angle or opening made by the two halves of the rule. With a finely pointed pencil draw the angle on the paper as CBD.

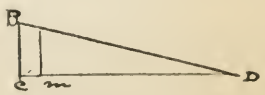


FIGURE 1.

With a scale ¼ inch to the foot, measure from B towards

C a distance equal to the known distance of your eye from the floor, from C erect a line at right angles to BC, prolong it until it intersects BD. CD is then the distance from the plumb line to end of floor. From C on CD measure off the recorded distance of plumb line from inside of wall as Cm. mD measured on the same scale will be the length required.

Note. This as well as the following methods are based on geometrical truths, and the only obstacle to perfect accuracy are: first, the difficulty of getting the true angle, or in other words to sight the rule right while holding the other part perpendicular over the mark; second, possibility of not getting the distance from eye to floor correct, and third, uncertainty as to the thickness of the wall. These difficulties, however, can be reduced with practice. The writer has frequently come within half an inch of the true distance.

SECOND METHOD

Another method, better than the preceding, is to place the lower part of the rule against the window pane or frame, bring end of upper half to your eye. Sight along the upper edge, moving the lower half of the rule up or down on the window glass, or the sighting part up or down, keeping the other pressed against the glass until the bottom of baseboard, or end of floor is on a line with edge of rule. Now without moving the rule make a mark on the glass or frame at the upper end of the lower part of the rule. Remove the rule carefully and place it flat on the paper as before. Draw the angle

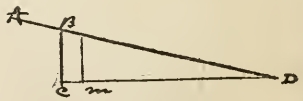


FIGURE 2.

on the paper as ABC. Prolong AB indefinitely, on BC, from B lay off to scale the distance BC, equal to distance of mark on glass or frame from floor, using as scale one-fourth inch to the foot. From C, and at right angles with CB, draw a line intersecting the prolonged AB in D. From C lay off to the same scale Cm, equal to the thickness of wall from glass, or if rule was held on frame or wall, the thickness of wall. mD measured on the same scale is the length required.

NOTE. It will be noticed that using this method no difficulty is experienced in holding the lower part of the rule perpendicular to the ground, as it rests against the glass or frame of the window, and if a lead pencil is split, the lead taken out and the wood again joined and a piece of it tied to each end of the upper part of the rule to sight by, or a little chalk or sulphur is rubbed on the ends for sights, the difficulty of getting the angle correctly will be partly overcome. The higher the eye is from the floor, the better the results obtained.

The third method will be readily understood by studying the illustration.

FIRST METHOD

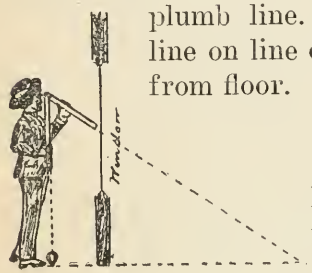
Bring A to the eye and sight along AB, AC being plumb with the ground and over the mark. In drawing angle, lay AC on line representing the height of eye from floor.

SECOND METHOD

Bring C to the eye and sight along CA, AB being pressed against window. In drawing angle, lay AB on line representing the height of A from the floor.

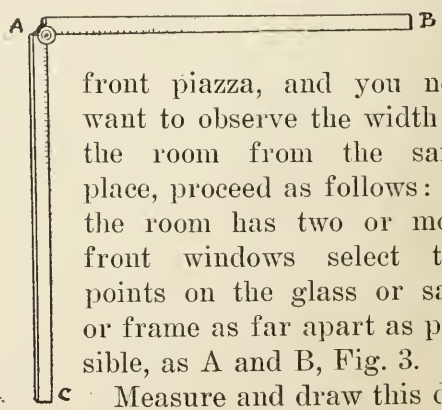
THIRD METHOD

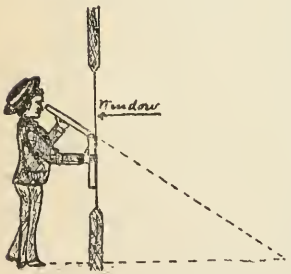
Attach plumb line to B, bring A to the eye, sight along AC, when point is in sight tip rule, and lay finger on plumb line. In drawing angle lay plumb line on line drawn to represent height of eye from floor.



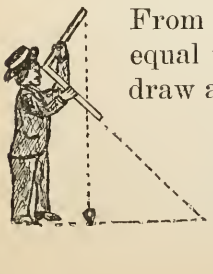
TO MEASURE THE WIDTH

Suppose you measure the length of the room by one of the preceding methods from the front piazza, and you now want to observe the width of the room from the same place, proceed as follows: If the room has two or more front windows select two points on the glass or sash or frame as far apart as possible, as A and B, Fig. 3.





Measure and draw this distance on paper to scale $\frac{1}{4}$ inch to the foot. From this line erect a perpendicular mn, equal to the length of the room. Through n draw a line parallel to AB. Now hold your rule horizontally on the window with the hinge on B, moving the other half and sighting along it across the room until the further corner is in line.



Remove the rule to the paper, place it so that the point of the angle when drawn will come on the point B, the part of the rule held against the window, on line AB, and with a finely pointed pencil draw the angle CBA, or the line CB. Now place rule at A and proceed in like manner to get the angle DAB; place the rule again on the paper at A, and draw the line AD. The distance between the intersecting points C and D, measured on the $\frac{1}{4}$ inch scale, is the width required. If there is only one window available, that will suffice, but it is evident that the further the points A and B are apart the more accurate will be the result.

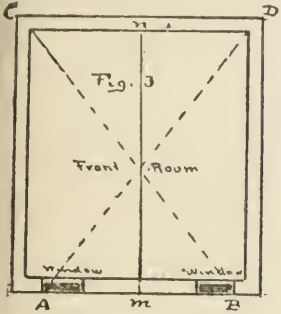
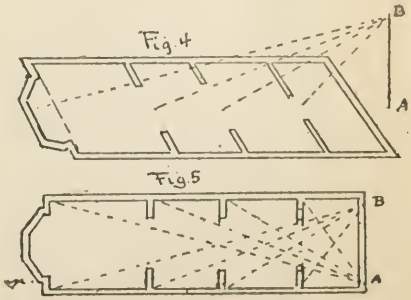


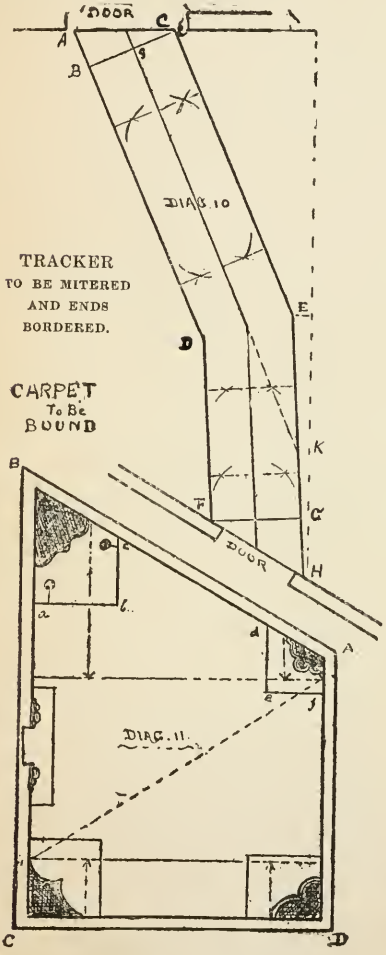
FIGURE 3.

Any number of rooms can be thus measured by the above methods from one point, if the floor and corners can be seen, as, observe Fig. 4, where the length AB will be the same for each triangle and only the angles change, or in Fig. 5, where the distance AB is the same for all the triangles and only the horizontal angles change. If the height of the ceiling above the eye can be determined, the ceiling may be observed in place of the floor with the same result. Other



FIGURES 4 AND 5.

method of finding the length and width could be given, but as they would require the use of instruments they need not be explained here.



DIAGRAMS 10 AND 11.

Find by measurement the center of doorways from which the tracker is to run, from these centers snap chalk lines in the desired direction, until they intersect. On each of these lines erect perpendiculars crossing them, mark off half the width of tracker each side of center line, through these points produce chalk lines which will represent the trackers, chalk line from C and F perpendicular to AB and EH. Measure AB, AD, CE, also DF, HG, HE; these are all the measures necessary if the tracker is to be in two parts, if in one take the additional measure on center line from S to K.

CARPET TO BE BOUND—DIAGRAM 11

Take a piece of stiff wrapping paper, place it on the floor one edge against the molding. Take the dividers and with one of its feet on the paper, the other touching the molding, follow the curves of the same, tracing the outlines on the paper; cut away the paper between this line and wall and this will give a mold which can be further improved by putting in place and going over it with pencil. Now square up the edges running from the walls and mark upper side of paper pattern. Mark floor to represent the paper. Measure room as for a bordered carpet, taking all necessary measures very accurately. Locate marks on floor representing the patterns by measurements on the plan.

PART V

TYPICAL DIAGRAMS AND MEASUREMENTS EXPLAINED

The following diagrams have been selected from a large collection, and represent the average shapes of rooms, together with some more rarely encountered, but produced to show a correct and practical way of measuring any irregular room. Each diagram is explained, and it will be noticed that the chalk line is brought into frequent use. This is recommended, because if the chalk line is relied on at the start, the measurer will learn to be methodical and consequently find his work easier. The tape, if held taut, may serve in place of the chalk line if this is not at hand, and, with a pencil or piece of chalk, make a mark on the floor along the edge of the tape. In some of the diagrams the measures are given, in others they are omitted, as it is desirable to have the student take his own measures, using any scale in doing so, and from these measures reproduce the plan. Thus not only giving practical exercise in the use of the scale, but also a better understanding of what measures are required to reproduce the diagram. The fine lines represent chalk lines, the dotted lines, measures, and the arrow heads points from and to which measures are taken.

Diagrams 26, 27, 28, and 29 represent the same room measured in four different ways.

In Diags. 26 and 27 chalk lines are used; it is called the "square" system, because the chalk line is supposed to be laid out perpendicular, or at right angles to the side of the room from which we start, and all measures taken from this chalk line being at right angles to it.

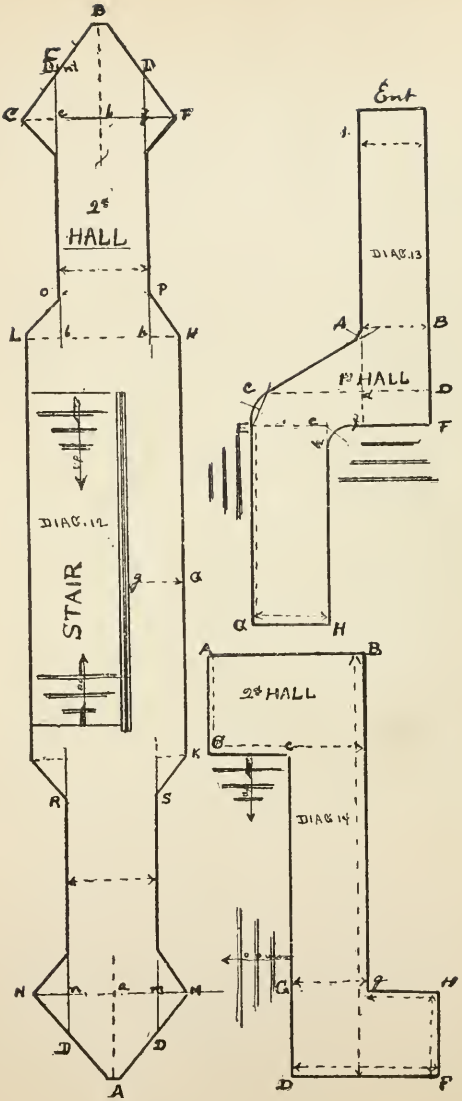
In Diags. 28 and 29 no chalk lines are used; it is known as the triangular system, measures being taken in such a manner as to divide the room into a series of triangles, one side at least being a wall line.

By a combination of the two systems it is possible to save time both in measuring and striking out the plan, at the same time bringing the possibility of an error down to a minimum. When using the last system triangles having too obtuse or too acute angles should be avoided, because in striking out the plan, the nearer the arcs cross each other at right angles, the more definite will be the point of intersection. In all cases of triangulation a length and width measure should be taken for a check, but not used for striking out the plan.

In Diag. 29 measures could be taken from A to C, D, E, and F, and from B to H, G, and F, then GD and BE will be checks, but it can also be struck out with two measures less as shown in diagram.

DIAGRAM 12

Chalk lines from M to N and C to F. Measure width LH, RS, and Gg. Fasten tape at m, on MN. Measure to f on CF, noting angular points and offsets, with your rule measure offsets from tape to M, K, H, and F, measure Aa, Bb, and from MN to both stairs, or if the line will clear from end to end, fasten line at A, noting the corners and taking offsets as before.



DIAGRAMS 12, 13, AND 14.

DIAGRAM 13

Measure from A to B, D to C, from F to f, c and E, C to H. From entrance to A, d and f and to B, D, and F, from c to h and H, E to G and curves.

DIAGRAM 14

Measure DF, Gg, gH, Cc, and AB, from D to c and AB, also CA, from DF to g, c, and B.

DIAGRAM 15

Extend RO with chalk line from O to K and R to r, mn to P, chalk line from m and V perpendicular to mn and QV.

Measure MN, NK, Nn, pP, pQ, Vr, VL, from A to M and N, from W to K, P, O, R and r, from v to r, L, all the wall lines and cross measures.

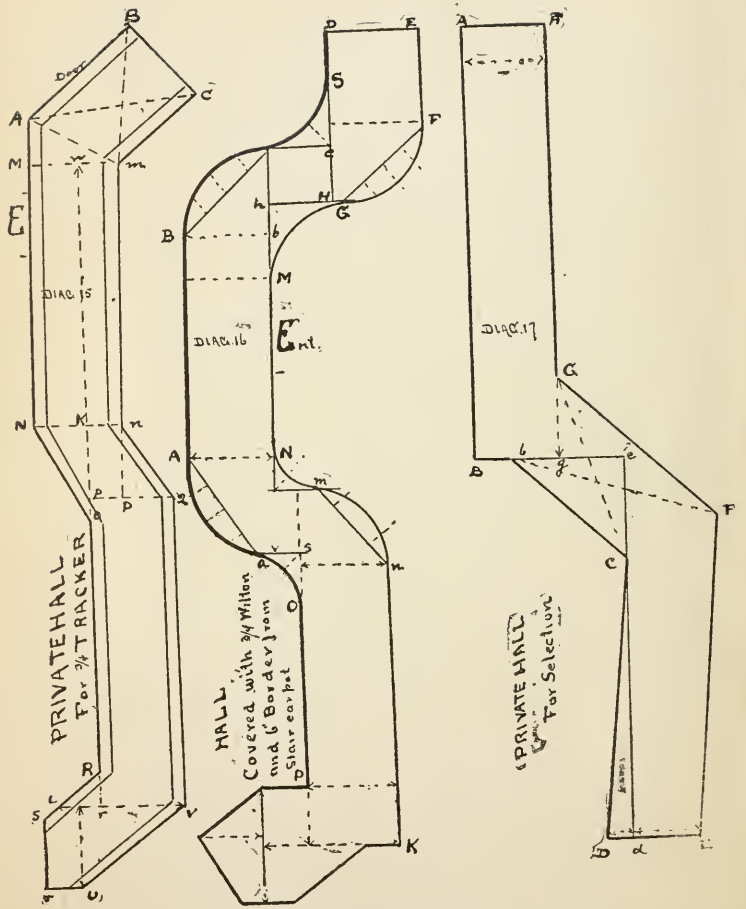
DIAGRAM 16

Chalk line from S to H parallel to EF, and from H perpendicular to it, prolong MN and OP both ways, from a and m draw lines perpendicular to them, measure across curves, offsets, straight walls, angles, and all measures as shown by dotted lines.

DIAGRAM 17

Extend Bb to any point as c, with chalk line from c snap second line to DE so it will touch the corner C.

Measure from H to G and g, from c to C and d, from B to b and c, from d to D and E. All wall lines and take cross measures as shown by dotted lines.



DIAGRAMS 15, 16, AND 17.

DIAGRAM 18

Chalk line from A to B across swell, bisect and measure depth of it to W; measure from each end of this line A and B to wall at stair C and D; measure width of hall from wall to baluster.

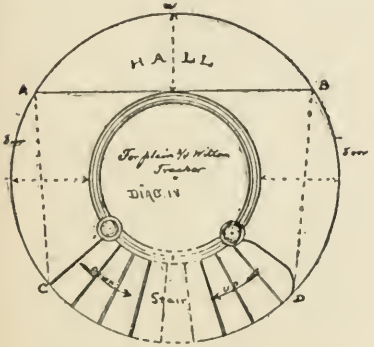


DIAGRAM 18.

DIAGRAM 19

Prolong AB to C; bisect BC with DE; from E on curve draw EE both ways parallel to AC, chalk line from G through f to F perpendicular to Ee, from M perpendicular to GF, from S perpendicular to xM, prolong it to N, from T and P perpendiculars to NSM. Measure AB, AC, entrance to c, E, F, and e. Aa, ab, DE, offsets at c and F. Ff, Fx, FG, with offset to both curves. XM and offsets every six inches. MN, MS, Mp, Mn with offsets as before. pP, pQ, with offsets to curves, also QR.

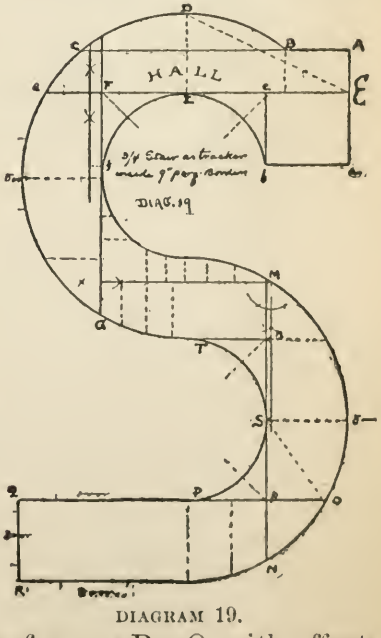


DIAGRAM 19.

STAIR MEASURE

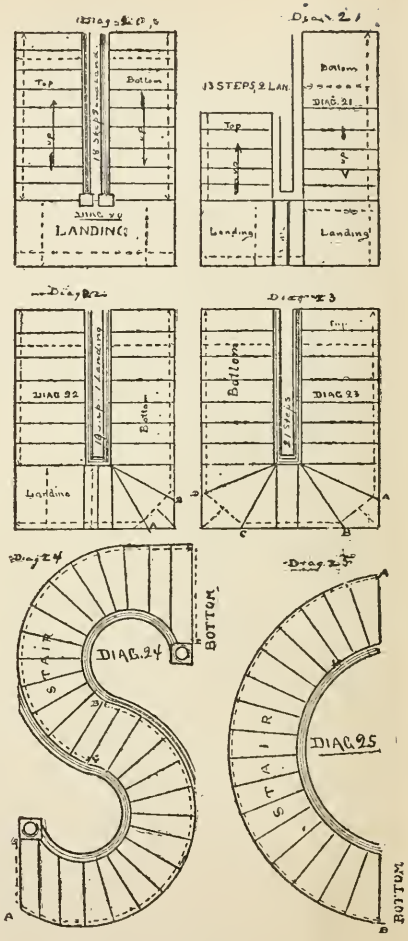
Always Count the Steps Going Up

DIAGRAM 20

Begin to measure from the top, as you can do it quicker going down than up. Measure the length and width of each part of the stair and landing separate and mark the parts top, bottom, and landing. Give number of steps.

DIAGRAM 21

Measure from top of stair to second landing, also the width of this part, and landing. Measure from wall on second landing over and to the bottom of middle part. Take width of first landing, and length from wall over landing to bottom of first part. Give number of steps and landings.



DIAGRAMS 20, 21, 22, 23, 24, AND 25.

DIAGRAM 22

Measure from top of stair to landing, and from wall of landing to A, B, and bottom of stair. Give width of stair and landing, also distance from corner of baluster to corner of wall.

DIAGRAM 23

From top of stair to A, B, C, D and bottom, give width of stair, and distance from corners of baluster to corners of walls.

DIAGRAM 24

Measure from A at top of stair following mopboard down to the beginning of concave curve B. Move the line over to the opposite side, and measure from C at the beginning of the convex curve to the bottom, and then the different widths of steps shown on the tape.

DIAGRAM 25

Measure the concave or longest side of the stair.

DIAGRAM 26

From any point L on EF snap chalk line, LK, on the floor as near square as possible to EF. Select and mark the two points b and a. Measure EL, EF, LK, La, Lb and FK, bD, aC, bG, aH, FG, GH, KA, BA, BC, CD, Dc, Df, DE, and fm. Strike out in the same order.

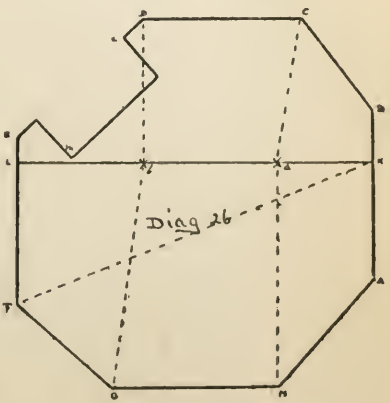


DIAGRAM 26.

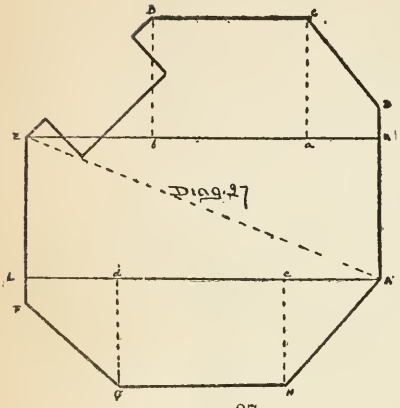


DIAGRAM 27.

USE THE FOLLOWING SYSTEM WHEN MEASURING FOR ESTIMATES

DIAGRAM 27

From corner E snap chalk line at right angles to EF, or as near as possible. Parallel to this line and at the distance KA, snap another chalk line LA. On these two lines select and mark points a, b, c and d, opposite corners C, D, H, and G, measure LK, EK, Ea, Eb, aC, bD, KA, EL, EF, LA, Lc, Ld, cH, dG, FG, GH, HA, AB, BC, CD, and DE in the order named.

Note in Diag. 26 the chalk line is not at right angles to EF, but its true direction is given by the diagonal measure FK. The points a and c are selected so that one offset, Db and Ha on opposite sides of the chalk line are at right angles to it. The measures bD and bG taken without removing the awl, so are aC and aH.

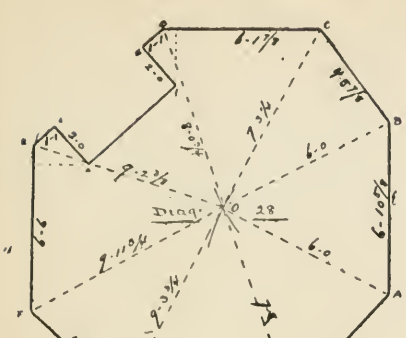


DIAGRAM 28.

DIAGRAM 28

With a convenient length on the tape and A as a center, describe an arc, with B as center and the same radius describe an arc cutting the first in a point as O. Fasten the tape at O and measure to all the corners. Measure all wall lines.

To reproduce. Snap a chalk line, on which lay the length AB. From A and B as centers and AO as radius locate O. Fasten tape at O and with the recorded measures as radius describe arcs for each corner. With A as center and AH as radius describe an arc cutting the one already drawn at H. Proceed in like manner all around the room, working from A to E and from B to D.

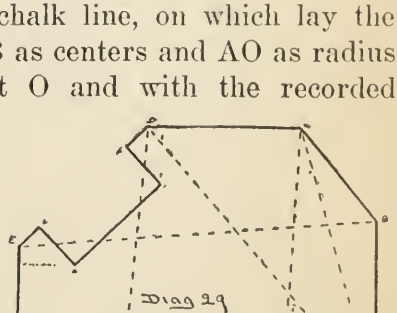


DIAGRAM 29.

DIAGRAM 29

Take the measures from points and in the order named. From A to B, C, D, F, and H. From B to C and E. From C to D and H. From D to G, from H to G, from G to F, from F to E.

To reproduce. Snap chalk line, on which lay the length AB. From A, B, and the other points as found, and with the length of the respective sides, describe arcs, proceeding in the order named above in taking the measures.

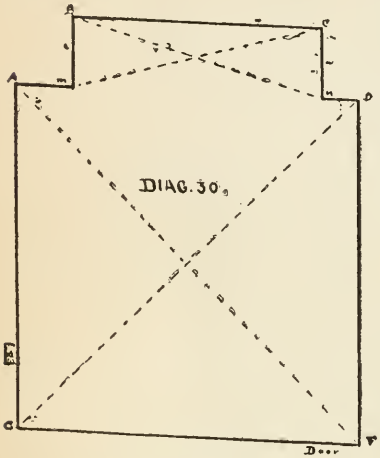


DIAGRAM 30.

DIAGRAM 30

Measure from A to m, n, and D, from A to F. From C to A, F, and D. From F to D. From m to B and C, from n to C and B and from B to C construct in the same order.

DIAGRAM 31

Snap chalk line from A to F across opening of window, measure from A to s, n, m; s and F, from A to G, from H to G, F and A, from G to D, P, and F, from S to D and B, from m to D. From S to C and E and from n to C, measure BC, CD, and DE. Construct in same order.

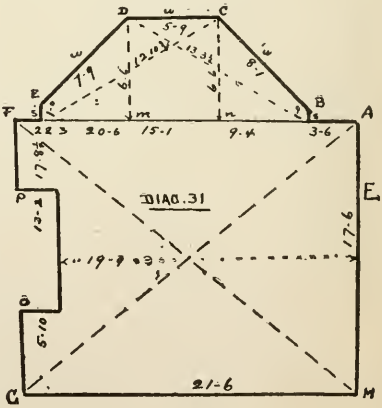


DIAGRAM 31.

DIAGRAM 32

Measure from A to B, m, o, C and H, from P to K, C, and A. Snap chalk line from A to C, on it set distance KP, measure from n to K, from C to M and H. Measure from B to D, m to D, D to F, o to F, and M to F. Measure across and locate the hearth. Measure HL for a check. Construct in the same order.

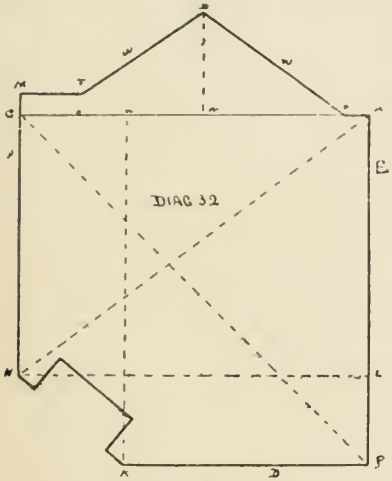


DIAGRAM 32.

DIAGRAM 33

Chalk line from A to B, measure from C to A, B, and D. From A to m, n, B, X, and D, from B to D and Y, from M to X, n to Y, and last XY.

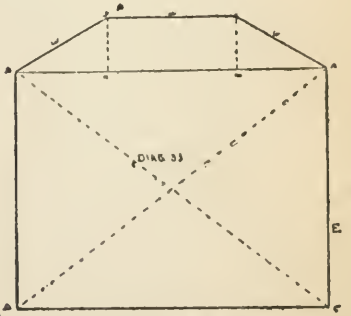


DIAGRAM 33.

DIAGRAM 34

Prolong FA with chalk line on it from F to m, set distance EC, measure from F to A, E, and C, from m to B and C, from C to D and E, from E to D, and DH, for check. Find center of circular window measure radius, depth nw, and mn.

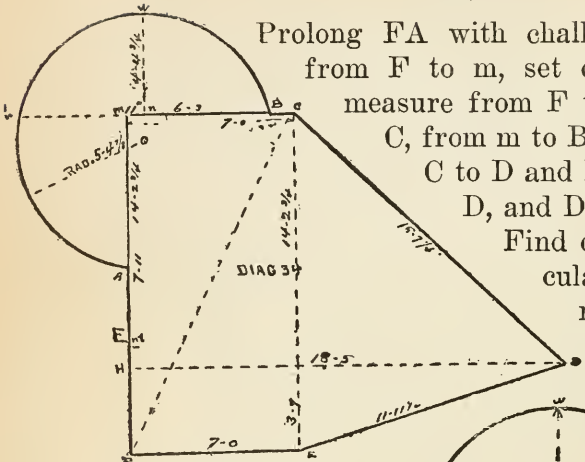


DIAGRAM 34.

DIAGRAM 35.

Chalk line from c to F, and from C perpendicular to AD, measure from A to c, s, H, F, and D, also to B, from B measure to C and perpendicular to CH, measure HK, HC, and DC, measure the inside opening of the swell, locate center and measure radius, depth sw and thickness of wall.

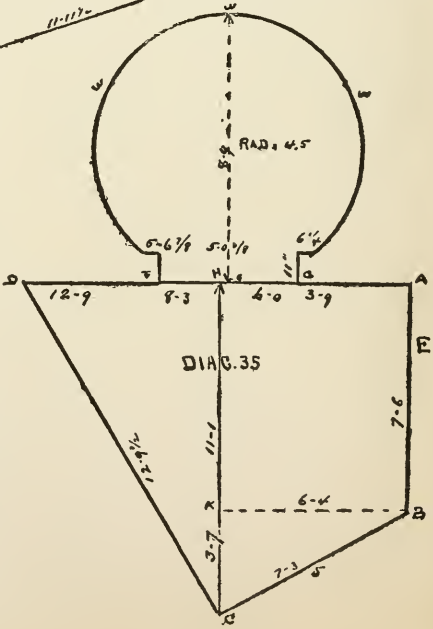


DIAGRAM 35.

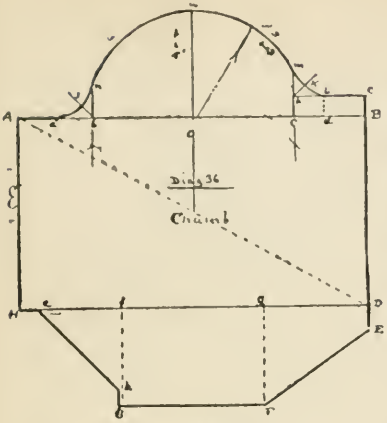


DIAGRAM 36.

Kk by laying the rule or tape so as to bisect the angles abn, Lkm, measure He, Hf, Hg, HD, also wall lines and offsets.

DIAGRAM 37

Chalk line from A to B, C to D in parlor, take offsets every 12 in. from A to B, also at b, p, r, and s on CD. Locate doorway from C, mantel from D; give depth of same; measure length and breadth of room.

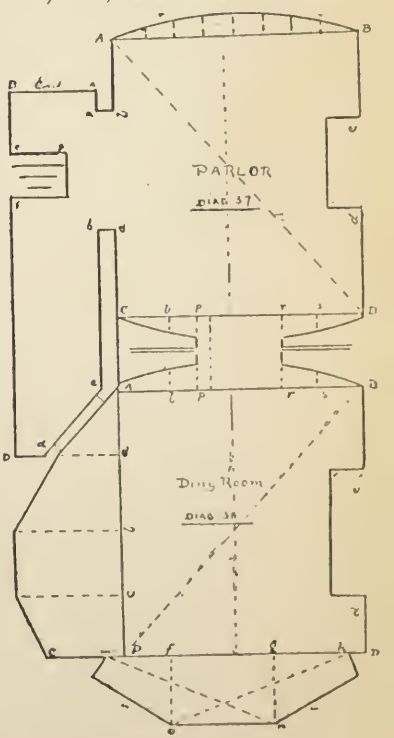
DIAGRAM 38

DINING ROOM

Chalk lines from M to h.

DIAGRAM 36

Chalk lines from A and H to B and D. Let fall a perpendicular from junction of concave and convex part of swell as m, n to b, c. Find center of circle, Prob. 7, Meth. 2. Measure Aa, Ab, Ac, Ad, AB. Measure Sb,



DIAGRAMS 37 AND 38.

From A to B parallel with CD in parlor, and from A to any point P, locate and measure offsets a, b, c, f, g, l, p, r, and s. Measure BP, mn, h, o, all walls in room and window, pp and the whole length from line mh to AB in parlor.

HALL

Measure Aa, Ab, Ac, Be, Bf, BD, BA, eg, cd, and Dd. Give thickness of wall at parlor door.

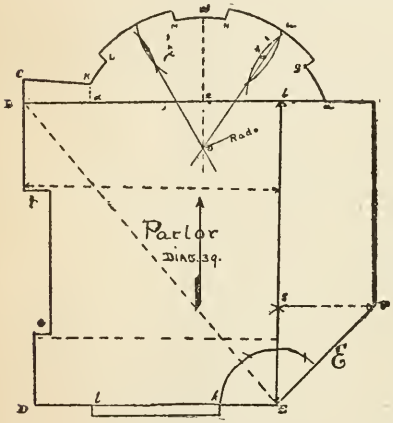


DIAGRAM 39.

DIAGRAM 39

Chalk line from A at right angles to AF, touching opposite wall at B. Find center of circle by Prob. 7, Meth. 2. Chalk line from center perpendicular to AB, chalk line from E perpendicular to ED.

Measure Aa, Ab, Ac, Ad, and AB, measure radius, offsets cW and dK, locate window recesses by measuring from a to g, a to N, also KL and KM, measure E to S and b, and SF, also from e and f to Eb, measure from E to k, l, and D, and depth of door, De, Df, DB, DC, EF, and FA.

DIAGRAM 40

Find center of circle, Prob. 7, Meth. 2, 3 or 4, chalk line from A perpendicular to AE, or if more convenient from a to B, across the swell. In the former case, set the shortest distance of the center C from side AB, from A to M,

in the latter, bisect aB and set ow perpendicular thereto. Measure radius, depth of swell, aA, aB, AB, AD, BF, EF, EA, ED, DB.

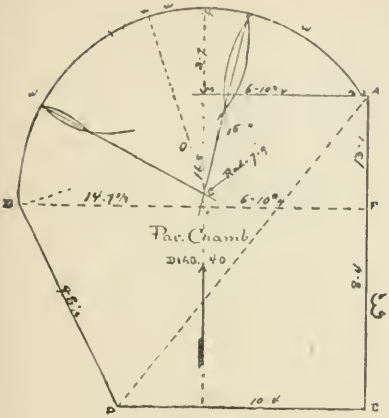


DIAGRAM 40.

NOTE. If the distance CO or CM is known the center is located and this measure with the radius forms a check, but as the depth OW or MK should be given, if possible, this subtracted from the radius gives OC or OM, and the depth OW added to the chord AB gives length of swell nearly if semicircle or less.

DIAGRAM 41

Chalk line from A to B, also from A and B to any point C. Measure from A and B towards C every 12 in. offsets from chalk line to swell, using near edge of tape or rule in doing so. Measure depth CF, cross measures, and wall line.

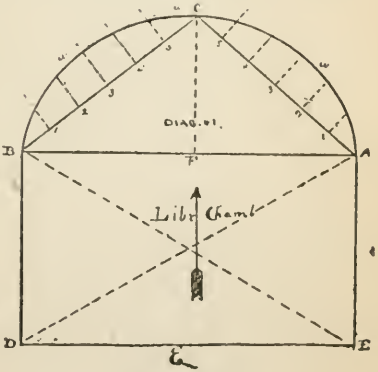


DIAGRAM 41.

DIAGRAM 42

Chalk line from B to C, fasten line at B and with any convenient length strike an arc. Ring at C, and the same or any other length, strike an arc cutting the former, from this point, O, measure to all corners in window, also

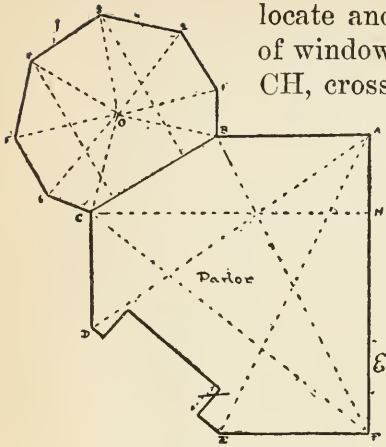


DIAGRAM 42.

locate and measure offsets and sides of window. In room measure BC and CH, cross measure from A to D and E, F to C and B and rest of room as before. Or measure window, taking cross measures from B and C to corners, not forgetting offsets, or measure as in Diag. 43. whichever way is most convenient.

DIAGRAM 43

Chalk line from h to g; to this line snap chalk line from r and n. Measure Ah, Am, Ap, Ag, AB, also Ha, Hx, HK, measure pn, mr, locate and measure offsets, sides, and chalk lines. In room measure as in window of Diag. 42. using any two corners to start from; or draw perpendicular line from B to FG, and measure offsets from it to corners; measure wall lines.

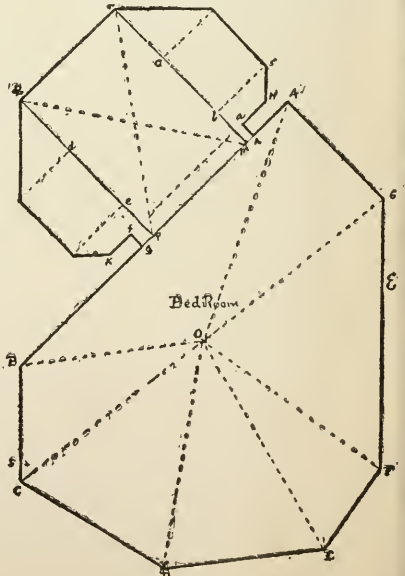


DIAGRAM 43.

NOTE. *The method of* taking all the cross measures from one point is the

quickest as the ring end of the tape does not have to be shifted either when measuring or striking out the room.

DIAGRAM 44

Chalk line from B to D, D to F, A to F, C to D. Find center of circle by Prob. 7, Meth. 3. Measure and locate window recesses as per Diag. 39, give depth of same, all wall lines, chalk lines, cross

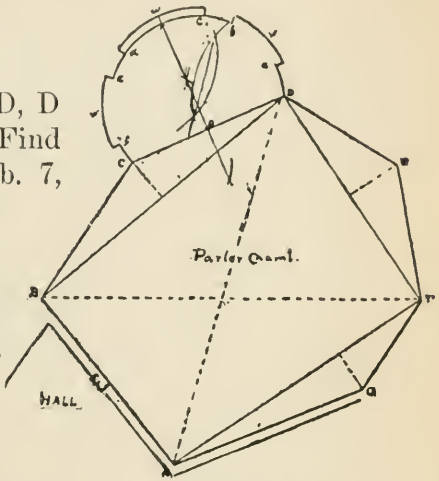


DIAGRAM 44.

measures AD and BF, and offsets.

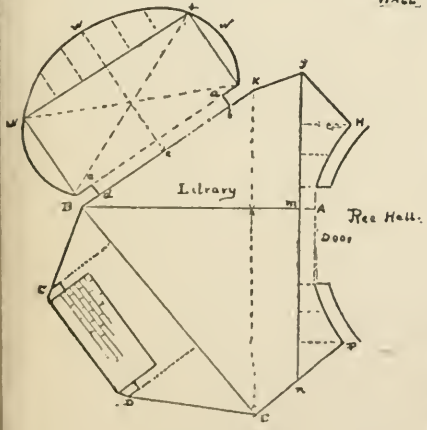


DIAGRAM 45.

DIAGRAM 45

Let fall perpendicular from B to straight line across doorway, across this line BA, at right angles to it, snap chalk line from J, touching FE, chalk line from B to E and d to b. From a and c to swell, join them by another line, wx, on this last line mark points for offsets every 6 or 12 in., do the same on cW, and aX, also on JN, BA, BE, to corners and swell.

Take cross measures aW, cX, from W to e, a to b, all chalk lines, offsets, wall lines, and depth of mantel and door.

DIAGRAM 46

All the measures necessary in this room are to find the lengths of the diameters AB and CD. As it is difficult sometimes to locate these lines, the center not being known, proceed as follows: Snap any two chalk lines parallel to each other on the floor, as EF and GH. Bisect these lines in K and L, through K and L draw a line, meeting the curved wall in M and N. Bisect MN in O, the center of the room. With O as a center and any convenient length in the tapeline as a radius, touch and mark the baseboard or floor at the points 1, 2, and 3. Through O draw lines parallel to lines joining the points 1 and 2, 2 and 3, these lines are the axes or diameters required. To make sure that the room is an ellipse, or to strike out the plan, proceed as in Prob. 8. If not an ellipse measure as in the window of Diag. 45.

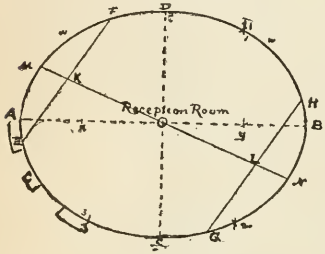


DIAGRAM 46.

DIAGRAM 47

In this plan the parlor, reception hall, two bedrooms, and two passages are to be carpeted, and it is necessary to locate the rooms exactly as well as give correct measures. Start at any prominent part, say in the parlor, at the door AB erect a line perpendicular to AB, extend as far as it will go on both sides; from this line snap DO

at right angles thereto, also line to reception hall. Determine the direction of this line by a line nn, on ok in the reception hall erect another perpendicular, preferably at the longest point of the hall, as it will then be the

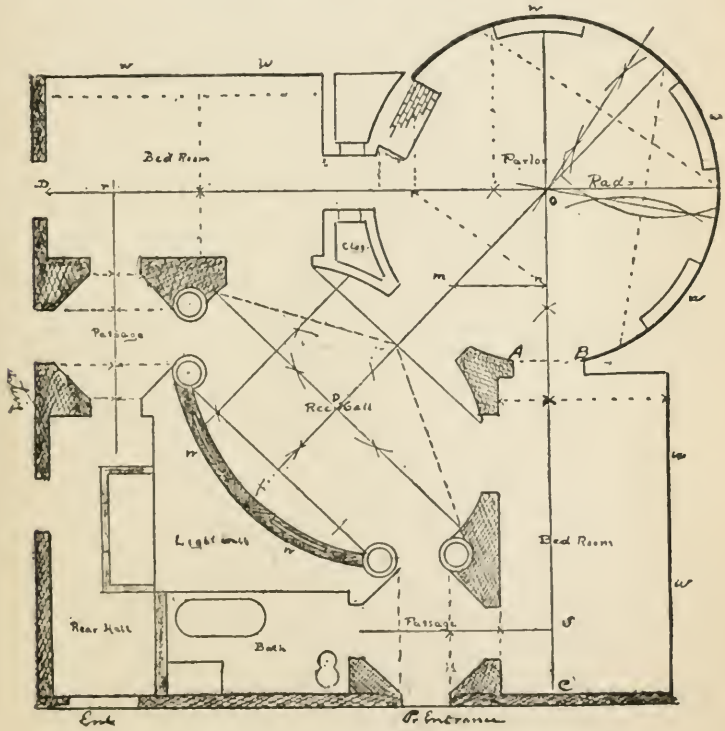


DIAGRAM 47.

transfer axis if the room is an ellipse, from r and s on DO and OC erect other perpendicular lines running to passages. Find center of circular room by any of the three methods, locate mantel and window seats as in Diag. 45,

by offsets, or as in Diag. 39, measure AB, On, OS, OC, also Or, OD, and OM, OP, Ok, measure length of bedrooms and width from chalk line in both directions, measure lines running through passages and offsets thereto, also walls in same, measure reception hall as in Diag. 46. or window in Diag. 45.

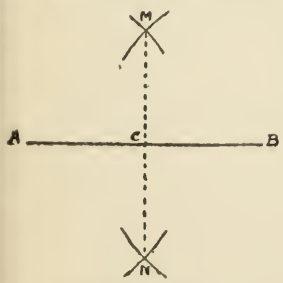
PART VI

SIMPLE GEOMETRICAL PROBLEMS

PROBLEM 1

To Divide a Given Line into Two Equal Parts.

From A and B as centers and any length on your tape as a radius, describe arcs cutting each other in M and N. Draw the line MCN and it will cut the given line into two equal parts. It will also be perpendicular to AB.

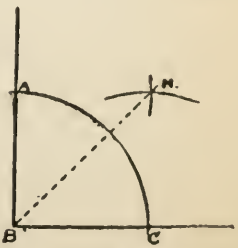


PROBLEM 1.

PROBLEM 2

To Divide a Given Angle, ABC, into Two Equal Parts.

From B as a center with any radius describe the arc AC. From A and C with one and the same radius, describe arcs intersecting in M. Draw a line from B to M and it will bisect the angle as required.



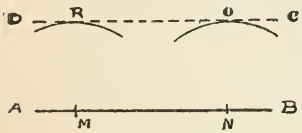
PROBLEM 2.

PROBLEM 3

To Draw a Line Parallel to a Given Line and at a Given Distance.

Let AB be the given line. From any two points as M

and N in the line AB, with a radius equal to the given distance describe the arcs R and O. Draw CD to touch these arcs without cutting them. This will be the parallel required.

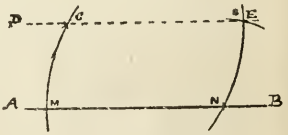


PROBLEM 3.

PROBLEM 4

When the Parallel Line is to Pass through a Given Point, C.

From any point N in the line AB with NC as a radius describe the arc CM. From the center C and with the same radius describe the arc SN. Take the straight distance from C to M and apply it from N to S. Through C and S draw DE, the parallel required.



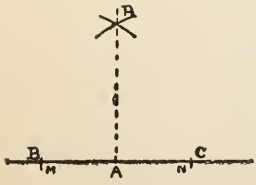
PROBLEM 4.

PROBLEM 5

To Erect a Perpendicular from a Given Point, A, on a Given Line, BC.

Case 1

When the point is near the middle of the line. On each side of the point, A, set off any two equal distances, as AM and AN, with M and N as centers and any radius greater than MA, describe two arcs intersecting in R. Through A and R draw the line AR, and it will be the perpendicular required.

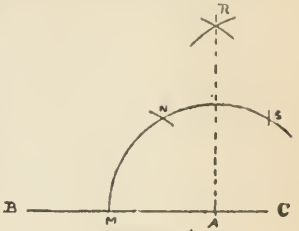


PROBLEM 5.

Method 1

When the point is near the end of the line or on it, with the center A and any radius, describe the arc MNS; with the same radius or length lay off on the arc from M and N the distances MN and

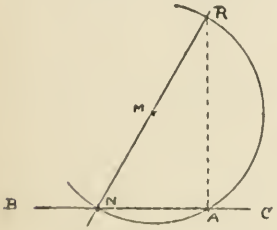
NS. Again, with N and S as centers, describe arcs intersecting in R. Then draw AR.



METHOD 1.

Method 2

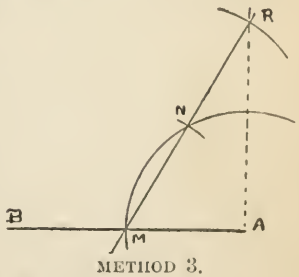
From any point M as a center with the radius or distance MA on tape draw an arc cutting the given line in N and A. Through M and N draw a straight line, cutting the arc in R; lastly draw AR, which is the perpendicular



METHOD 2.

Method 3

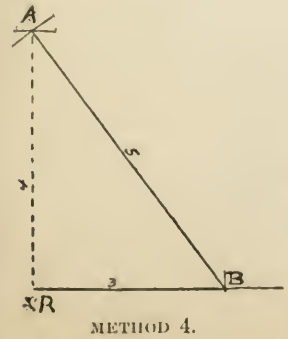
From A as a center and any radius describe an arc MN, with M as center and the same radius describe an arc at N. N as center and the same radius describe arc at R. Through MN draw a straight line cutting arc at R, join R and A, which gives the perpendicular.



METHOD 3.

Method 4

From any scale of equal parts on the tapeline, set off from R to B three such parts, with R as center and four parts as radius swing an arc. B as center and five parts as radius, describe an arc cutting the former in A. A line drawn from R to A is the perpendicular.



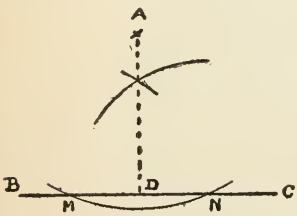
METHOD 4.

NOTE. This method is commonly used by carpet measurers and is correct if the tape used is true, but as three different lengths are used, if only one is out, the line will not be a perpendicular, and should it vary only ½ of an inch at 3 ft. it would at 25 ft. be about five inches out of square. Of course, any length most convenient can be used, as (1 ft. 6 in., 2 ft., and 2 ft. 6 in.) or (three, four, and five,) or (six, eight, and ten.)

PROBLEM 6

From a Given Point, A, to Given Line, BC, to Let Fall a Perpendicular.

With the center at A and any radius describe an arc cutting BC at M and N. With M and N as centers and the same or any other radius describe arcs intersecting in R, draw ADR for the perpendicular.

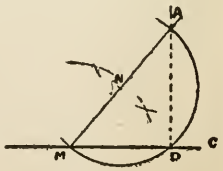


PROBLEM 6.

Case 2

When the point is nearly opposite the point of the line.

From A draw any line AM to meet BC. Bisect AM at N, with N as center and radius AN describe an arc cutting BC in D. Draw AD, the perpendicular required.



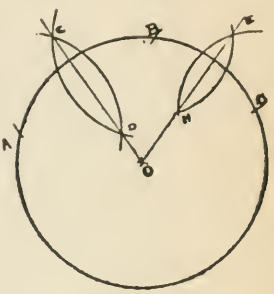
CASE 2.

PROBLEM 7 *Method* 1

To find the Center of a Given Circle or Part of a Circle.

With any radius and any point on the circumference

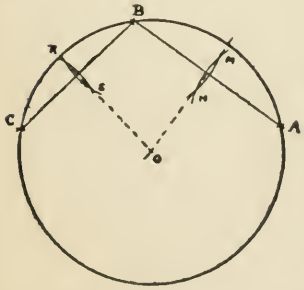
as at A, describe an arc, with the same radius and another point as B describe an arc cutting the former in two places C and D, from C and through D draw a line CDO and it will pass through the center. In like manner draw another line EHO and it will cross the first at the center required.



PROBLEM 7.

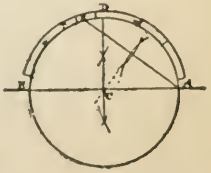
Method 2

When a window is in the form of a circle mark any three points on the circumference as ABC. Take A as a center and a length on the tape greater than half the length AB, describe an arc MN. With B as a center and the same radius swing another arc cutting the former in M and N. Again with B as center and a little more than half the distance from B to C describe an arc RS, C as center and the same radius describe an arc cutting the former at RS. Through RS and MN draw straight lines which will cross at the center.



Method 3

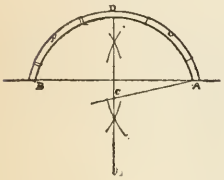
Bisect AB and erect a perpendicular which when prolonged will pass through the center. Draw a line from A to any point on the circumference, the nearer the middle of it

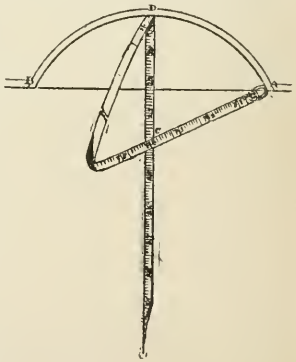


the better, bisect this line and draw a perpendicular from it, crossing DC at the center required.

Method 4

Bisect AB and draw a line perpendicular through the middle of it; on this line lay your tape, touching with its 20 ft. mark the wall at D, the big numbers running towards C, (the eyelet at 21 ft. mark recommended before will here come in handy for your awl). Tighten the tape on the line; go back and pull up the awl, taking care not to disturb the line; fasten the ring end of the line at A; bring it over the part of the tape already laid out; move it up or down until the marks on both parts touching each other correspond; when 20 is subtracted from the first part, if the tape is true, the marks will come together at the center required. This method is recommended when a carpet is on the floor, as then it is sometimes difficult to get a chalk line to show.

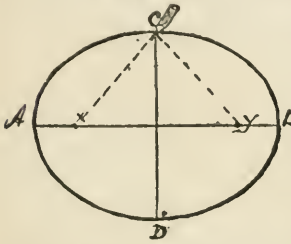




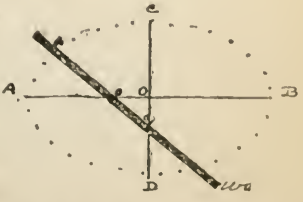
Method 5 (*see Circular Arc*)

To Construct an Ellipse

Let it be required to describe an ellipse whose diameters or axes are 12 and 8 feet respectively. Draw a line AB equal to the longest axis 12 feet, bisect and draw a line CD through the bisecting points; on this line lay off the length of the short axes, half on each side from AB. Take half the length of the long diameter on your dividers or tape as a radius and with the points C or D as centers describe an arc cutting AB in x and y. The points x and y are then the two foci points. Place a pin or tack at each of these points, also one in C or D. Fasten the end of an inelastic cord or string to the tack at x, bring it around the tack at C, pull it taut and fasten the other end to the tack at y. Now pull out the tack at C and replace it with a pencil or piece of chalk, and, keeping a steady tension on the string, move the pencil as far as possible first on one, then on the other side of the long diameter and trace the elliptic curve.



Or mark half the length of the long diameter as AO on a long straight edge, then lay this straight edge on the short diameter, first mark A at C, and mark off the short diameter OC from A. Place the two marks OO so they will always touch the two diameters. And the mark A will trace the curve.



PART VII

COMMON ARITHMETIC

Simple Addition

In adding up one or more columns of figures never add a single figure at a time. Every figure must be seen and used but not pronounced, therefore in memorizing keep your mind free from words, and do not say three plus five plus nine equals seventeen, but simply three, five, nine seventeen. Commence at the bottom of the right-hand column and add upwards, then by writing the carrying figure at the top of the next column and so on, we have the advantage of being able to leave our work in the middle of the operation and return at leisure to finish it without going over the figures already added. In the following example only part of the answer is written to illustrate the advantage of this method.

	23		
Ex. 1.	352	*Proof.* Add each column separately as before and to the right, mark down the sum of each column so they will advance one figure from right to left.	30
	564		25
	812		29
	529		3180
	287		
	636		
	80		

Second Method. Proof. Find the excess of 9's in each horizontal line, then by adding all the excesses together and dividing the sum by nine, the remainder should be the same as the remainder of the sum of the digits in the total sum divided by nine. The operation should be performed mentally, but to illustrate, the figures are written in the following example.

$$\begin{array}{r}
3+5+2=10-9=1 \\
5+6+4=15-9=6 \\
8+1+2=11-9=2 \\
5+2+9=16-9=7 \\
2+8+7=17-9=8 \\
6+3+6=15-9=6 \\
\hline
3+1+8+0=12-9=3,\ 30-27 \quad 3
\end{array}$$

Short Methods in Multiplication

To multiply any two figures by 11:

Rule. Place the sum of the two figures between them for the answer. If the sum is more than ten, increase the left hand figure by one.

Ex. 1. $11\times25=2+5=7$; then 275 the answer.
Ex. 2. 11×79, $7+9=16$, then 869 is the answer.

To multiply more than two figures by 11:

Rule. Write the first right hand figure; prefix to this the sum of the first and second, then the sum of the second and third etc. Then write the left hand figure. Carry when necessary.

Ex. 3. $56879\times11=625669$.

CROSS MULTIPLICATION

A Rapid and Practical Method

Ex. 4. Multiply 45×34=1530.

Explanation. We first say 4×5=20 (always reserve carrying figure) write down 0 and carry 2, next 4×4=16+2 (the carrying figure)=18+3×5=33, write down 3 and carry 3, next 4×3=12 plus 3=15, write it down and the product is complete: 1530.

Ex. 4. Multiply 465 by 382.

$$\begin{array}{r} 465 \\ 382 \\ \hline 177630 \end{array}$$

The frequent use of this method tends to increase the ability of retaining large sums in the head; after a little practice great speed in multiplying two numbers may be attained.

TO MULTIPLY ANY NUMBER BY NINES

Ex. 5. Multiply 9999 by 5634=56334366 answer.

Explanation. Write down the multiplier, less one, and subtract the multiplier less one from the number of nines.

TO MENTALLY MULTIPLY ANY TWO SUMS FROM 10 TO 20

Ex. 6. Multiply 15×12.

Explanation. We first say 2×5=10, next 2+5 and one to carry=8, place in the mind the figure 1, and after it 8

and 0 or 180. Try it and you have increased your multiplication table from 12 to 20. Carry if any.

To multiply by 5. Annex one cipher and divide by 2.

To multiply by 25. Annex two ciphers and divide by 4.

To multiply by 50. Annex two ciphers and divide by 2.

To multiply by 125. Annex three ciphers and divide by 8.

To multiply by 250. Annex three ciphers and divide by 4.

Vulgar Fractions

A fraction means a part of anything. If an apple be cut into eight equal parts, each part will be called an eighth of the whole apple and is written $\frac{1}{8}$. This $\frac{1}{8}$ is a fraction. If we had three or five or seven of these pieces of the apple we would represent it by $\frac{3}{8}$ or $\frac{5}{8}$ or $\frac{7}{8}$ as the case might be. All these are fractions. A Vulgar Fraction is always represented by two numbers (at least), one over the other and separated by a small horizontal line. The number above the line is called the numerator, the number below the line the denominator.

The denominator tells us into how many parts the whole has been divided, and the numerator tells us how many of these parts we have. Thus in the above fraction $\frac{3}{8}$, the 8 shows that the apple has been divided into 8 equal parts and the 3 shows that we have 3 of those pieces or parts of the apple.

A Proper Fraction is one whose numerator is less than its denominator as $\frac{3}{8}$, $\frac{2}{5}$ or $\frac{1}{4}$. An improper fraction is one whose numerator is more than its denominator as $\frac{8}{3}$, $\frac{5}{2}$, or $\frac{4}{1}$; $\frac{8}{3}$ means more than a whole one, because $\frac{3}{3}$ must

be a whole. Then $\frac{8}{3}$ will be 3 thirds plus 3 thirds plus 2 thirds or $2\frac{2}{3}$ and this form is called a mixed number.

A single fraction is a simple expression for any number of parts of the integer.

A compound fraction is the fraction of a fraction as $\frac{1}{2}$ of $\frac{2}{3}$, $\frac{3}{4}$ of $\frac{5}{6}$, etc.

Any whole number may be expressed like a fraction by writing 1 under it as $\frac{3}{1}$.

The common measure of two numbers is that number which will divide each of them without a remainder. Thus 3 is the common measure of 12 and 15; and the greatest number that will do this is called the greatest common measure.

A number, which can be measured by two or more numbers, is called their common multiple and if it be the least number which can be measured, it is called their least common multiple, thus 30, 45, 60, and 75 are multiples of 3 and 5, but their least common multiple is 15.

PROBLEM 1

To find the greatest common measure of two or more numbers.

Rule. If there be two numbers only, divide the greater by the less, and this divisor by the last remainder, and so on; always dividing the last divisor by the last remainder, till nothing remains, then will the last divisor be the greatest common measure required.

When there are more than two numbers, find the greatest common measure of two of them as before, and of that common measure and one of the other numbers and so on, through all the numbers to the last, then will

the greatest common measure last found be the answer. If 1 happens to be the common measure, the given numbers are prime to each other and found to be incommensurable.

Ex. 7. What is the greatest common measure of 3168, 2860, and 1980?

Operation:

1	9	3	2	
3168 |	2860 |	308 |	88 |	44
2860	2772	264	88	
308	88	44		

44)1980=45.

44 is the greatest common measure required.

PROBLEM 2

To find the least common multiple of two or more numbers.

Rule. Divide by any number that will divide two or more of the given numbers without a remainder and set the quotients, together with the undivided numbers, in a line beneath.

Divide the second line as before; and so on until there are no two numbers that can be divided; then the continued product of the divisor and quotients will give the multiple required.

Example. What is the common multiple of 3, 5, 8, and 10?

5)3, 5, 8, ~~10~~
2)3, 1, 8, ~~2~~
3, 1, 4, 1,

Then $5\times2\times3\times4=120$, the answer.

Reduction of Vulgar Fractions

Reduction of vulgar fractions, is done by changing them from one form to another, in order to prepare them for the operation of addition, subtraction, etc.

Case I. *To reduce fractions to their lowest term*

Rule. Divide the numerator and denominator of the given fraction by any number that will divide both of them without a remainder and these quotients again in the same manner and so on until it appears that there is no number greater than 1 which will divide them, and the fraction will be reduced to its lowest term. Or, divide both terms by the greatest common measure, and the quotient will be the terms of the fraction required.

Example. Reduce $\frac{144}{240}$ to its lowest terms

$\frac{144}{240} \div \frac{8}{8} = \frac{18}{30}$, $\frac{18}{30} \div \frac{6}{6} = \frac{3}{5}$, the answer.

Or thus. Greatest common measure=48, 48)$\frac{144}{240} = \frac{3}{5}$.

Note. Any number ending with an even number or a cipher, is divisible by 2. Any number ending with 5 or 0 is divisible by 5. If the right hand figure of any number be 0, the whole is divisible by 10. If the two right hand figures are divisible by 4, the whole number is divisible by 4. If the three right hand figures are divisible by 8 the whole number is divisible by 8. If the sum of the digits constituting any number be divisible by 3 or 9 the whole is divisible by 3 or 9.

When numbers, with the sign of addition or subtraction

between them, are to be divided by any number, each of the numbers must be divided. Thus:

$$\frac{4+8+10}{2}=2+4+5.$$

But if the numbers have the sign of multiplication between them, only one of them must be divided. Thus:

$$\frac{3\times8\times10}{2\times6}=\frac{3\times4\times10}{1\times6}=\frac{1\times4\times10}{1\times2}=\frac{1\times2\times10}{1\times1}=\frac{20}{1}=20.$$

To Reduce a Fraction of Any Denomination to One Having a Desired Denominator

Rule. Multiply the old numerator with the new denominator. Divide the product by the old denominator; the quotient is the new numerator of the fraction with the desired denominator.

Example. How many quarters are equal to $\frac{5}{8}$? $\frac{5}{8}\times4=20$, $20\div8=\frac{2\frac{1}{2}}{4}$.

How many 12ths are equal to $\frac{25}{100}$? $12\times25=300\div100=\frac{3}{12}$.

Example. The length of a room is given as 15-3 measured by a surveyor's tape 10 inches to the foot. To what length on the cutter's tape does it correspond?

$\frac{3}{10}\times12=\frac{36}{120}\div10=\frac{3\cdot6}{12}=3\frac{5}{8}$ inches, and 15 feet $3\frac{5}{8}$ is the length on the cutter's tape nearly.

How to Add Fractions

Find the sum of $\frac{3}{4}$ and $\frac{5}{9}$.

Explanation. $4\times5=20$; $3\times9=27$; $20+27=47$, which is

the numerator of the answer, and the product of the denominators $4\times9=36$, the denominator of the answer, $\frac{47}{36}$.

Find the sum of $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{5}{8}$.

Multiply 2 by 8 of the denominators by 2 in the numerator equals 32, next 2×3 (denominators)$=6$ by 5 (numerator)$=30$, next 3×8 (denominators)$=24$ by 1 (numerator) $=24$, $32+30+24=86$, the numerator of the answer, and $2\times3\times8$ (the denominator)$=48$, the denominator of the answer $\frac{86}{48}=1\frac{19}{24}$. Or, find the least common multiple of the denominators.

Divide this multiple by each denominator, and multiply the quotient by the numerator, the product is the numerator of each fraction, the sum of which will be the numerator of the answer, with the least common multiple as denominator.

Example. Add $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{5}{8}$ as before.

Here it is found that 24 is the smallest number which can be divided by 2, 3, and 8 without leaving a remainder; it is therefore called the least common dividend or multiple.

2 in 24=12, $12\times1=12$, first numerator.
3 in 24=8, $8\times2=16$, second numerator.
8 in 24=3, $3\times5=15$, third numerator.

Sum of the numerators=43. The numerator of the answer.

Least common multiple=24. The denominator of the answer.

To Subtract Fractions

From $\frac{3}{4}$ take $\frac{2}{3}$.

Explanation. Multiply 3 (numerator) by 3 (denominator)=9.

Multiply 2 (numerator) by 4 (denominator)=8. 8 from 9 leaves 1, the numerator of the remainder. The product of the denominators $4\times3=12$ is the denominator of the answer.

Multiplication of Fractions

Rule. Change all the factors to the form of fractions. Reduce crosswise and multiply straight, then the product of all the numerators is the numerator, and the product of all the denominators, the denominator of the answer.

Example. $\frac{4}{5}\times108\,;\ \frac{4}{5}\times\frac{\overset{12}{108}}{1}=48.$

Example. $2\frac{2}{3}\frac{6}{5}\times2\frac{1}{2}\frac{1}{2}\times7,\ \frac{\overset{8}{8}}{\underset{5}{5}}\times\frac{\overset{5}{5}}{\underset{2}{2}}\times\frac{7}{1}=8\times7=56.$

How much is $\frac{5}{8}$ of $\frac{3}{5}$ of $\frac{7}{3}$ of 14? $\frac{5}{8}\times\frac{3}{5}\times\frac{7}{3}\times\frac{\overset{7}{14}}{1}=\frac{21}{4}=10\frac{1}{4}.$

Division of Fractions

Reverse the divisor and proceed as in multiplication.

Example. $\frac{3}{4}\div1\frac{1}{8}=\frac{3}{4}\div\frac{9}{8}$, reverse the $\frac{9}{8}$ then $\frac{\overset{1}{3}}{1}\times\frac{2}{\underset{3}{4}}=\frac{2}{3}.$

Second Method

Draw two parallel lines and write the dividends on the upper line, and divisors on the lower. Multiply the numbers outside the lines for the numerator and those on the inside for the denominators of the answer. Always cancel factors common to both terms.

Example. Divide $\frac{1}{2}$ of $\frac{3}{8}$ by $\frac{3}{4}$ of $\frac{5}{6}$.

$$\begin{array}{cc} 1 & 3 \\ \hline 2 & 8 \\ \cancel{3} & 5 \\ \hline 4 & \cancel{6} \\ & 2 \end{array} \Bigg\} = \frac{24}{80} = \frac{3}{10}$$

MULTIPLICATION OF MIXED NUMBERS. GENERAL RULE

To multiply any two mixed numbers. Find the product of the whole numbers and the product of the fractions, and add to this amount the product of the lower fraction by the upper whole number, and the upper fraction by the lower whole number. Multiply $21\frac{1}{5}$ by $15\frac{1}{7}$.

Explanation. An outline of the operation is here given, but in practice the partial product should be added mentally as they occur.

$$\begin{array}{rl} 21\frac{1}{5} & \\ 15\frac{1}{7} & \\ \hline 315 & =21\times15 \\ 3 & =\frac{1}{7} \text{ of } 21 \\ 3 & =\frac{1}{5} \text{ of } 15 \\ 0\frac{1}{35} & =\frac{1}{5}\times\frac{1}{7} \\ \hline \end{array}$$

Answer$=321\frac{1}{35}$

A PRACTICAL BUSINESS METHOD

As it is only necessary to get the answer to the nearest cent, when it is less then one-half, drop it; and when one-half or more call it one cent. By this method entire dis-

regard of fractions in the partial product renders a mistake or error almost impossible.

Multiply $11\frac{1}{4} \times 9\frac{1}{3}$.

Explanation. $\frac{1}{3} \times 11 = 3\frac{2}{3}$; call it 4 because it is nearer 4 than 3.

$\frac{1}{4} \times 9 = 2\frac{1}{4}$; call it 2.

4+2=6 plus the product of the whole number 99=105.

$$\begin{array}{r} 11\frac{1}{4} \\ 9\frac{1}{3} \\ \hline 105 = \text{Answer.} \end{array}$$

Duodecimals

Duodecimals are so called because they decrease by twelves, from the place of feet towards the right hand. Feet are sometimes marked with a comma at the top thus ′, inches with two commas ″, and parts of inches with three commas ‴.

RULE

1. Under the multiplicand write the same names or denominations of the multiplier; that is, feet under feet, inches under inches, parts under parts.

2. Multiply each term in the multiplicand, beginning at the lowest, by the feet in the multiplier, and write each result under its respective term, observing to carry a unit for every 12 from each lower denominator to its next superior.

3. In the same manner multiply every term in the multiplicand by the inches in the multiplier and set the

result of each term one place removed to the right of those in the multiplicand. Proceed in like manner with all the rest of the denominations if there be any; and the sum of all the lines will be the product required. Or the denominations of the particular product will be as follows: When feet are concerned the product is of the same denomination with the term multiplying feet. When feet are not concerned, the name of the product will be expressed by the sum of the indices of the two factors.

Example. Find the number of square feet in a rug, sixe 10 ft. $4\frac{3}{4}$ in.$\times$7 ft. $8\frac{1}{2}$ in.

$$\begin{array}{r} 10' \quad 4'' \; 9''' \\ 7 \quad 8 \; 6 \\ \hline 72 \quad 9 \; 3 \\ 6 \; 11 \; 2 \; 0 \\ 5 \; 2 \; 4 \; 6 \\ \hline 80' \quad 1'' \; 7''' \end{array}$$

$=(80+\frac{1}{12}+\frac{7}{12}$ of $\frac{1}{12}$ square feet) or 80 square feet and 19 square inches, the answer.

To find the number of square feet in a rubber mat, size 4′ 5″$\times$5′ 7″.

$$\begin{array}{r} 4' \; 5'' \\ 5 \; 7 \\ \hline 22 \; 1 \\ 2 \; 6 \; 11 \\ \hline 24' \; 7'' \; 11''' \end{array}$$

$=(24+\frac{7}{12}+\frac{11}{12}$ of $\frac{1}{12}$ square feet$)=24\frac{95}{144}$ square feet, or 24 feet 95 inches square, or $24\frac{5}{8}$ square feet, nearly.

Decimal Fractions

A decimal fraction is a part of a whole which has been divided into 10, 100, 1,000, etc., number of parts. It is commonly expressed by writing the numerator only, with a point before it called the separatrix or decimal point, thus:

.1=one tenth.
.01=one hundredth.
.001=one thousandth.
.0001=one ten-thousandth.

Ciphers on the right of the decimals do not alter their value. But ciphers on the left and after the decimal point diminish the value in a tenfold proportion for every cipher.

The use of decimals in figuring is very convenient, particularly when dollars and cents constitute one of the factors.

Addition of Decimals

Rule. Set the numbers under each other according to the value of their places, as in whole numbers, or so that the decimal points shall stand each directly under the preceding. Then add as in whole numbers, placing the decimal point in the sum directly under the other points.

Examples.

	237
	25.23
	3.056
Add	163.113
	0.045
	428.444

	0.56
	1.25
	0.002
Add	2.1
	3.652
	7.564

Subtraction of Decimals

Rule. Set the less number under the greater in the same manner as in addition. Then subtract as in whole numbers and place the decimal point in the remainder directly under the other points.

Examples.	365.24	2.986
	2.153	0.213
	363.087	2.773

First answer is, three hundred and sixty-three whole and eighty-seven thousandths.

Second answer is, two whole and seven hundred and seventy-three thousandths.

Multiplication of Decimals

Rule. Set down the factors under each other and multiply as in whole numbers. In the product from right to left point off as many figures as there are decimals in both factors.

If there are not so many figures in the product as there ought to be decimals, prefix the proper number of ciphers to supply the defect.

Example. Multiply 43.35 by 0.156=6.7626.

Ex. 2. 4.25×4.5=19.125.

When decimals are to be multiplied by 10, 100, 1,000, etc., move the decimal point one, two, three, or more places to the right.

Example. Multiply 3.25 by 10=32.5=Thirty-two whole and five-tenths.

Division of Decimals

Divide as in whole numbers, point off for decimals in the quotient from left to right as many figures as the decimals in the dividend exceed those in the divisor.

Example. Divide 81.4025 by 32.561=2.5.

32.561)81.4025(2.5
65.122
16.2805
16.2805

To divide by 10, 100, 1,000, etc., move the decimal point one, two, three, or more places from right to left.

To Reduce Vulgar Fractions to Decimals

Attach any number of ciphers to the numerator and divide this by the denominator, being sure to have a figure in the answer for each cipher attached.

Example. Reduce ¼ to a decimal. 4)100=0.25.

How much is $\frac{5}{8}$ of a foot reduced to decimals? 8)50=0.625.

THE FOLLOWING TABLES SHOW VULGAR FRACTION AND THEIR EQUIVALENT DECIMALS

$\frac{1}{32}$ of an inch=0.032	¼ of an inch=0.25	$\frac{5}{8}$ of an inch=0.625
$\frac{1}{16}$ " " =0.063	$\frac{3}{8}$ " " =0.375	$\frac{3}{4}$ " " =0.75
⅛ " " =0.125	½ " " =0.5	$\frac{7}{8}$ " " =0.875

12 INCHES OR ONE FOOT THE WHOLE NUMBER

$\frac{1}{32}$=0.0104	$\frac{7}{8}$=0.073	6=0.5	$\frac{1}{32}$	of a foot or		$\frac{3}{32}$	inches	=0.032
$\frac{1}{16}$=0.0208	1=0.083	7=0.583	$\frac{1}{16}$	"	"	$\frac{3}{4}$	"	=0.063
$\frac{3}{32}$=0.0313	2=0.167	8=0.667	$\frac{1}{8}$	"	"	$1\frac{1}{2}$	"	=0.125
$\frac{1}{24}$=0.0417	3=0.25	9=0.75	$\frac{3}{8}$	"	"	$4\frac{1}{8}$	"	=0.375
$\frac{5}{96}$=0.0521	4=0.333	10=0.833	$\frac{5}{8}$	"	"	$7\frac{1}{2}$	"	=0.625
$\frac{1}{16}$=0.0625	5=0.417	11=0.917	$\frac{7}{8}$	"	"	$10\frac{1}{2}$	"	=0.875

ONE YARD OR 36 INCHES THE WHOLE NUMBER

1 in.=0.028	10 ins.=0.278	19 ins.=0.528	28 ins.=0.778	$\frac{1}{8}$	= $4\frac{1}{2}$	ins.	=0.125
2 ins.=0.056	11 ins.=0.306	20 ins.=0.556	29 ins.=0.806	$\frac{1}{4}$	= 9	ins.	=0.25
3 ins.=0.083	12 ins.=0.333	21 ins.=0.583	30 ins.=0.833	$\frac{3}{8}$	=$13\frac{1}{2}$	ins.	=0.375
4 ins.=0.111	13 ins.=0.361	22 ins.=0.611	31 ins.=0.861	$\frac{1}{2}$	=18	ins.	=0.5
5 ins.=0.139	14 ins.=0.389	23 ins.=0.639	32 ins.=0.889	$\frac{5}{8}$	=$22\frac{1}{2}$	ins.	=0.625
6 ins.=0.167	15 ins.=0.417	24 ins.=0.667	33 ins.=0.917	$\frac{3}{4}$	=27	ins.	=0.75
7 ins.=0.194	16 ins.=0.444	25 ins.=0.694	34 ins.=0.944	$\frac{7}{8}$	=$31\frac{1}{2}$	ins.	=0.875
8 ins.=0.222	17 ins.=0.472	26 ins.=0.722	35 ins.=0.972	$\frac{1}{16}$	=$2\frac{1}{4}$	ins.	=0.063
9 ins.=0.25	18 ins.=0.5	27 ins.=0.75	36 ins.=1	$\frac{1}{32}$	=$1\frac{1}{8}$	ins.	=0.032

PROPORTION, OR THE RULE OF THREE

In problems to be solved by the rule of three, three quantities are given to find the fourth.

The following is a form of simple proportion:

If we call the unknown quantity x; 2 is to 4 as 6 is to x and is written 2 : 4=6 : x. It is here seen that the problem is composed of four terms of which 2 and x are called the outside terms, 4 and 6 the inside terms. Now if the unknown quantity, x, is one of the outside terms its value is equal to the products of the inner terms divided by the other outside term, but if x is an inside term, then its value is equal to the product of the outside terms divided by the other inside term. Thus in the above analogy $x=\frac{4 \times 6}{2}=12$ and by substituting the unknown quantity x

by the found term 12 we have 2 is to 4 as 6 is to 12, and $\frac{4}{2}=\frac{12}{6}=2$.

Ex. If it takes 12 yards of $\frac{4}{4}$ carpet to cover a room, how many yards of $\frac{3}{4}$ carpet will cover the same room?

12 yards $\frac{4}{4}$ wide
x yards $\frac{3}{4}$ wide
$x:12=\frac{4}{4}:\frac{3}{4}$ then $x=\frac{12\times4\times4}{4\times3}=16$ yards.

Rule. Write the terms belonging to the statement in one line, under it write the terms of the question, so that terms of the same name will come under each other. If from the nature of the question the answer is direct, the term involved, on the same line with the unknown will be one of the inside terms, but if the answer is indirect the term will have an outside place, or in the first case the involved term will stand second; in the second case it will stand first, the unknown are always placed last on the right hand side.

Example. If 9 men in 4 days working 8 hours per day can do a piece of work; how many days will it require for 7 men to do the same job by working 5 hours per day?

Explanation:

Statement, 9 men, 4 days, 8 hours
Question, 7 men, x days, 5 hours

$7:9=4:x$
$5:8=x:y$
$(7\times5):(9\times8)=4:y$ and

$y=\frac{9\times8\times4}{7\times5}=8\frac{4}{7}$ days nearly.

Formulate the questions and answers in the following

manner. If 9 men can do the work in 4 days; how many days will it take 7 men to do it? Answer: more days, less men. The answer is indirect and the lower term 7 will come outside or in first place. Again, we say, if it takes 4 days by working 8 hours per day, how long will it take working 5 hours per day? Answer: more days, less hours. Again the answer is indirect and 5 will be the outside term.

Example. Five men laid a house of carpets in 6 days; how many men will it require to lay the same house of matting in 4 days, when it consumes $\frac{1}{3}$ more time to lay the latter?

Explanation:

5 men, 6 days, 1 hard
x men, 4 days, $1\frac{1}{3}$ harder

$4 : 6 = 5 : x$
$1 : 1\frac{1}{3} = x : y$

$4 \times 1 : 6 \times 1\frac{1}{3} = 5 : y$

$$y = \frac{5 \times 6 \times 4}{4 \times 3} = 10 \text{ men, the answer.}$$

If 5 men can do the work in 6 days; how many men will it require to do it in 4 days? More men, less days; answer is indirect and 4 will be outside term. Again, if 5 men can do it in 6 days when it is 1 hard; how many men will it take to do it when it is $\frac{1}{3}$ harder. More men, harder work. Answer is direct and $1\frac{1}{3}$ will come in second place and be an inside term. In the first question x was the unknown, but was found. In the second, y is the unknown to be found.

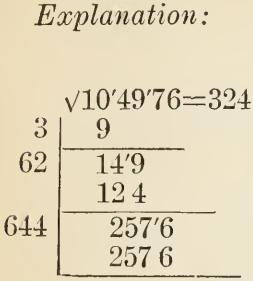
Square Root

Definition. To extract the square root from a number, is to find the number which multiplied by itself gave as a product the present number.

Rule. Separate the number under the root mark into classes, the whole number to the left, and the decimals (if any exist) to the right from the decimal point, with two figures in each class. Now take the first root figure, such that its square will be equal to, or just less than, the number in the first class. Subtract this square from the first class, and to the right of the remainder write down the next class and separate the last right hand figure from the rest by a comma. Next form a divisor of twice the found root and use this divisor to divide the number formed by the remainder and the first figure of the second class. The quotient is written to the right of the divisor, after which this new divisor is multiplied by the last root figure. The product is subtracted from the first remainder. To the right of this second remainder write down the figures of the third class, and proceed in like manner until there is no remainder, or by adding two ciphers to the right of each remainder the desired number of decimals are obtained in the root.

Example. Extract the square root from 104976.

Explanation:



Here 3 is the first root figure, 3 times 3=9; put 9 under 10 (the first class) and subtract. The remainder is 1, write down 49 (second class) and point off the last right hand figure 9 from the 14. Multiply the first root figure 3 by 2 and write the product 6, to the left of 149. Six in 14=2; 2 is the next root figure; put it down to the right of 3 in the root, and to the right of 6 opposite the 149. Multiply this 62 by 2, the second root figure=124, write it under 149 and subtract. To the remainder 25 prefix the next class 76 and point off the 6. Multiply 32 by 2 and write the product to the left of 257'6. 64 in 257 goes 4 times. 4 is the next root figure, write it to the right of 2 and 64 and multiply this 644 by 4 and write the product under the 257'6, which, there being no remainder, will finish the operation and give the root 324. Prove 324×324=104976.

PART VIII

TO ESTIMATE ON CARPETS

In times of keen competition, estimates have to be made on the smallest margin of profit. The success of a business venture depends, therefore, to a certain extent on the ability of the man doing the estimating. Nine times out of ten, everything else being equal, the one submitting the lowest estimate gets the job, and although the contract must of necessity show a profit, the real gain frequently will come through future orders, as a person of true economical ideas will have his work done where he is sure of honest treatment and satisfactory workmanship. Haphazard and careless estimating will bring the same results as other work done in this manner. A friend of the writer once remarked, when asked to what he attributed his success in business: "I give first credit to the man who did my estimating, for by his shrewdness my first large order was secured; secondly, to my workmen, whose good workmanship recommended my business until now orders flow in while estimates are rarely called for."

As it is necessary to know the length of figure or design in order to determine the point at which a carpet will cut to match, so it is equally important to know the length of space the carpet is to cover in order to determine the waste. Thus a carpet with a 48-inch pattern for

a floor measuring 15 ft. 10 in., would have no more waste than would be necessary for a turn-under, or two inches, on each breadth, whereas the same pattern would waste one-half yard on each breadth for a floor fourteen feet six inches long. Again, take a nine-inch pattern for the room fifteen feet ten inches in length and the waste will be eight inches on each breadth, because in order to make it match the carpet must be cut where the figure repeats itself. Drop patterns have two cutting points, one, half the distance between the full length of the design, and the other where the figure is repeated, and in order to match such a carpet with the least possible waste, one breadth is dropped down beyond the others in cutting; this drop which is equal to half the length of the design, will, therefore, be additional waste. Hence, it is obvious that in order to give an accurate estimate, not only must the length of figure and length of room be known, but also the character of the design. It is also evident that the largest patterns do not always mean the greatest waste.

If more than one room is to be covered with a carpet of the same design the different lengths may be added together and estimated on as if for one carpet. Enough waste, however, must be allowed for each room to give sufficient turn-under. The table of cutting lengths on the last pages, has been computed for different length patterns from twelve to fifty-three inches, and will be found of practical use.

To apply these tables, first measure the full length of the design and ascertain if it is a " set " or a " drop " pattern. Then, having in mind the length of the room,

enter the table and column with the length of the pattern at the top, and if it is a " drop " pattern, the first number found, which corresponds to, or just exceeds, the length of the room, will show the cutting point. The letter S or M in the margin and on the same horizontal line will indicate whether the carpet cuts to a set or match at this length. But, if it is a " set " pattern, i. e., a pattern with only one cutting point, the length at which the carpet will cut to match can only be found on the same horizontal line with the letter S.

Example. A carpet with a 28-inch " drop " pattern is bought for a room 16-3 long. Which is the nearest cutting point, and will it cut to a " set " or " match " at this length?

In the column under 28″ we find 16′ 4″ as being nearest to the length of the room, and looking at the margin we find the letter S, which indicates that the carpet will cut to a " set " at this point, and, of course, a " set " pattern will cut the same length. Now take the same length pattern for a room 17′ 4″ long, and we find that the " drop " pattern cuts to a match at 17′ 6.″ But the " set " pattern will only match at 18′ 8″.

Sometimes it is required to submit estimate from a small sample from which it is difficult to determine whether the pattern is " drop " or " set." If, however, the sample is turned nap out, and the two selvages brought together, this difficulty is easily overcome.

The width multiplied by the length gives the area of any rectangular space, but when estimating for carpets the breadths and their proper alignment have to be considered. Therefore, first find the number of breadths

required, by dividing the width of room by the width of one breadth of carpet. If, however, there should be a fraction, and such fraction is less than one-half, a breadth half the length of the room can be split and the ends sewed together, i. e., cross-joined. When this is to be done the customer, if present, should be consulted, as some object to a cross-join, with the probable mismatch of one part, or for other reasons they may prefer to have the breadths left whole. If only a few inches are lacking, a breadth of sufficient length can be split into several strips wide enough to cover, an allowance of one or two inches should be made for turning under the raw edge. Attention to similar details is often the means of gaining the customer's confidence. For convenience the following table of widths for from one to twelve breadths $\frac{3}{4}$ goods, with $\frac{5}{8}$, $\frac{2}{4}$, and $\frac{1}{4}$ border added to each side, are given.

	1	2	3	4	5	6	7	8	9	10	11	12
$\frac{3}{4}$ goods	2.3	4.6	6.9	9.0	11.3	13.6	15.9	18.0	20.3	22.6	24.9	27.0
$\frac{5}{8}$ body and $\frac{5}{8}$ border.	6.0	8.3	10.6	12.9	15.0	17.3	19.6	21.9	24.0	26.3	28.6	30.9
$\frac{3}{4}$ body and $\frac{2}{4}$ border.	5.3	7.6	9.9	12.0	14.3	16.6	18.9	21.0	23.3	25.6	27.9	30.0
$\frac{3}{4}$ body and $\frac{1}{4}$ border.	3.9	6.0	8.3	10.6	12.9	15.0	17.3	19.6	21.9	24 0	26.3	28.6

To find number of yards required for a rectangular floor.

Rule. Multiply length of room by number of breadths, the product gives the number of yards net, if length is taken in yards and fraction thereof. If in feet and inches divide the product by three for the answer.

Note. If 3 breadths are considered, the length in feet and fraction will express the quantity in yards. Thus

12′ 3″=12¼ yards, 12′ 6″=12½ yards, 12′ 9″=12¾ yards, etc.

If the floor has the form of a trapezoid, i. e., has only one pair of opposite sides parallel, as in Fig. 1, and the difference in length of the parallel sides is slight, it can be estimated by regarding it as a rectangle. But, if the difference is great, as for example, in a room 15′ 9″ wide, one side of which measures 18′ 0″ and the opposite side 12′ 0″, it would make a difference of about six yards and would have to be considered if figuring against others.

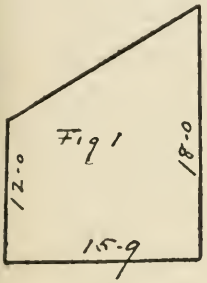


FIGURE 1.

There are three practical ways of determining the quantity required to cover any floor, viz.:

First by Construction; that is to say, by drawing the floor plan to scale, then the length of each breadth is easily found by measuring with the same scale used in constructing the plan. No matter how irregular a floor may be this method can always be depended on, and the larger the scale used the better results obtained. Half an inch to a foot is a convenient scale. The same measures are required to produce the plan on paper to scale, as would be used in striking out the plan on the floor, the rule and dividers being substituted for the tape.

Second, by finding the drop or difference in length of the breadths, and adding or subtracting, as the case may be, these several drops to or from the length of the first breadth.

Third, by the rules of mensuration modified by the

necessity of considering the figure and match of the pattern which require that the ends of each breadth be cut off square, thus adding so much waste to the geometrical area of the space covered.

The first method is general and can be used in all cases, and is withal so simple that further explanation is deemed unnecessary.

SECOND METHOD

To find the drop in a trapezoid, Fig. 1

Rule 1. Divide the difference in length of the two parallel sides by the number of breadths, the quotient giving the difference in length of breadths.

In a right-angle triangle

Rule 2. Divide the length by the number of breadths contained in the base or width.

Ex. 1. What will be the difference in length of breadths required for a floor like Fig. 1?

Here the sides are 12′ 0″ and 18′ 0″. Difference=6′ 0″=72 inches. End of room 15′ 9″=seven breadths. 72 inches divided by 7 gives a quotient of $10\frac{1}{4}$ inches=drop.

Ex. 2. How many yards $\frac{3}{4}$ plain carpet 14-inch pattern is required to cover a floor like Fig. 1, with and without allowing for waste in matching?

Entrance side=12′ 0″
Plus the drop=0 $10\frac{1}{4}$

1st breadth	=12	$10\frac{1}{4}$	and	cuts	12′	10″
2d "	=13	$8\frac{1}{2}$	"	"	14	0
3d "	=14	$6\frac{3}{4}$	"	"	15	2
4th "	=15	5	"	"	16	4
5th "	=16	$3\frac{1}{4}$	"	"	16	4
6th "	=17	$1\frac{1}{2}$	"	"	17	6
7th "	=17	$11\frac{3}{4}$	"	"	18	0

Number of yards, net, 107′ 11″÷3=36; waste allowed, 110′ 2″÷3=37 yards.

NOTE: When this method is used always write down the length of the several breadths, one under the other, then compare the number and the width of the room to make sure no breadths are omitted. When adding, draw a line across top of column and above this place the carrying figure, thus making it possible if interrupted to resume the work where left off.

THIRD METHOD

Rule 3. Multiply half the sum of the two parallel sides by the number of breadths. To the product add half their difference.

Ex. 3. Find how many yards is required to cover a floor like Fig. 1 by this method.

Longest side	=18′ 0″	Half sum	= 5 yards
Shortest side	=12 0	Number of breadths	= 7
Sum	=30′ 0″	Product	= 35 yards
Half sum	=15 0	Half difference . .	=+1
Half difference . . .	= 3 0	Number of yards, net	= 36 yards

As it is better not to figure too close on account of some small difference in length of pattern which may occur in different rolls of the same pattern, if one foot is added to each breadth for a 14-inch pattern, the last method will make the estimate 38⅓ yards and give ample allowance.

When the floor is in the form of a right-angle triangle.

FIRST METHOD BY CONSTRUCTION

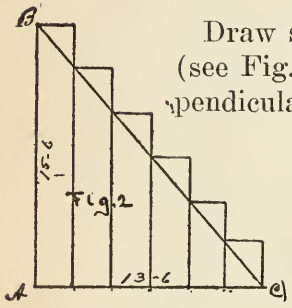


FIGURE 2.

Draw side AB to scale and equal to 15.6 (see Fig. 2). From point A erect AC perpendicular to AB and equal to 13.6. Join B and C. On AC mark off the width of the breadths; from these marks draw lines parallel to AB. Measure AB for the first breadth and each line from AC to BC for the following breadths.

SECOND METHOD

Ex. 4. Drop of breadth to be deducted=6)15′ 6″= 2′ 7″.

First	breadth	=15′ 6″
Second	"	=12 11
Third	"	=10 4
Fourth	"	= 7 9
Fifth	"	= 5 2
Sixth	"	= 2 7
		3)54′ 3″ = 18½ yards net.

THIRD METHOD

Rule 4. Multiply half the length by the number of breadths, or vice versa. To the product add half the length.

Ex. 5. 2)15′6″ = 7′ 9″
Breadths = 6
46′ 6″
Half the length = + 7 9
3)54′ 3″ = 18½ yards, net.

NOTE. When in a triangular room, as above, the width requires five breadths of carpet, the length of the side in feet and inches gives the number of yards required. Thus a floor in the form of a right-angle triangle, Fig. 2, the end measures 11′ 3″ and the length 18′ 9″, here it requires 18¾ yards of carpets ¾ yard width.

When the floor has the form of a trapezium, Fig. 3.

BY THE SECOND METHOD

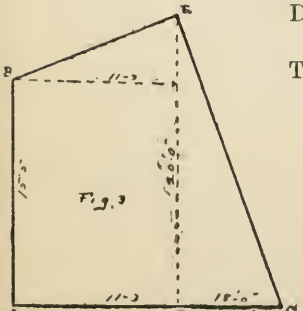


FIGURE 3.

Drop on BE = 11 inches, EC = 6′ 8″ } by Problem 2.
Then the 1st breadth = 15′ 5″ + 11″ = 16′ 4″
2d " = 16′ 4″ + 11″ = 17′ 3″
3d " = 17′ 3″ + 11″ = 18′ 2″
4th " = 18′ 2″ + 11″ = 19′ 1″
5th " = 19′ 1″ + 11″ = 20′ 0″
6th same as 5th = 19′ 1″ + 11″ = 20′ 0″
7th breadth = 20′ 0″ − 6′ 8″ = 13′ 4″
8th " = 13′ 4″ − 6′ 8″ = 6′ 8″
Number of yds., net, nearly = 130.10 ÷ 3 = 43⅓

THIRD METHOD

Rule 5. Divide the room into a trapezoid and a triangle. Estimate each separately and take the sum.

Ex. 7.

In trapezoid ABED:

$$5\left(\frac{15.5+20.0}{2}\right)+\left(\frac{20.0-15.5}{2}\right)=90'\ 10''\text{ or }30\tfrac{1}{4}\text{ yds.}$$

In triangle DEC:

$$\frac{3\times 20}{2}+\frac{20}{2} \qquad =40'\ 0''\text{ or }13\tfrac{1}{3}\text{ yds.}$$

And in the whole room ACEB, net sum nearly $43\frac{2}{3}$ yds.

NOTE. If length of pattern is known and added to each breadth in the second method, the exact number of yards can be found. Drop and length of pattern should be added mentally for practice.

When the floor is an irregular polygon, Fig. 4.

If the room has more than four sides all different in length, with no square corners.

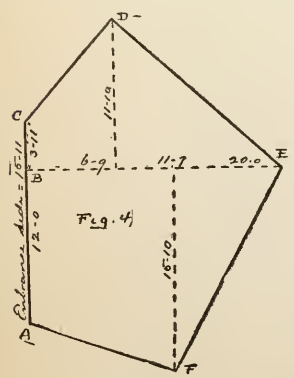


FIGURE 4.

Ex. 7. How many yards of $\frac{3}{4}$ plain Brussels (with and without allowance for matching) are required to cover a floor like Fig. 4, length of pattern 15″?

BY THE SECOND METHOD.

Drop on CD=2′ 8″
" " DE=2′ 0′
" " FE=4′ 0″
" " AF= 9½″

	1st Breadth	2d Breadth	3d Breadth	4th Breadth	5th Breadth	6th Breadth	7th Breadth	8th Breadth	9th Breadth
	15′ 11″	19′ 4½″	22′ 10″	26′ 3½″	27′ 1″	25′ 10½″	23′ 10″	17′ 10″	11′ 10″
Drop.....	on CD	CD	CD	.....	DE	DE	DE	DE	DE
	+2′ 8″	+2′ 8″	+2′ 8″	0′ 0″	−2′ 0″	−2 0″	−2′ 0″	−2′ 0″	−2′ 0″
Drop..	on AF	AF	AF	AF	AF	.....	FE	FE	FE
	+0′ 9½″	+0′ 9½″	+0′ 9½″	+0′ 9½″	+0′ 9½″	.....	−4′ 0″	−4′ 0″	−4′ 0″
	19′ 4½″	22′ 10″	26′ 3½″	27′ 1″	25′ 10½″	23′ 10″	17′ 10″	11′ 10″	5′ 10″

1st breadth	= 19′ 4½″		and cuts at	20′ 0″
2d "	= 22 10+ 6		" " "	23 9
3d "	= 26 3+10		" " "	27 6
4th "	= 27 1+ 3		" " "	27 6
5th "	= 25 10+ 9		" " "	27 6
6th "	= 23 10+ 6		" " "	25 0
7th "	= 17 10+ 6		" " "	18 9
8th "	= 11 10+ 6		" " "	12 6
9th "	= 5 10+ 6		" " "	7 6
	3)180′ 9″=60¼ yds., net.			3)189′10″=63⅓ yds. to match.

NOTE. The figures added to the second column denote the distance each breadth has to be dropped below the lines AF and FE in order to find the match.

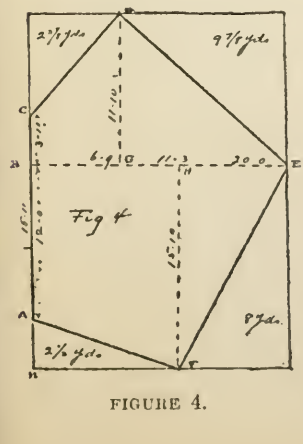


FIGURE 4.

BY THE THIRD METHOD

Rule 6. Make the floor into a rectangle by affixing triangles whose hypotenuses or longest sides will form sides of the room. Multiply the length of this rectangle by the number of breadths. From the product subtract the quantity in each triangle reduced by half its height.

NOTE. If there are three breadths on the base of the triangle subtract the height of the triangle from the square of the room.

Ex. 8. How many yards of ¾ plain Brussels will it take to cover a floor like Fig. 4? Greatest width BE=20′ 0″. Greatest length FH+GD=27′ 8″.

TRIANGLE ON CD.

DG =11′ 10″
BC =− 3 11
Half CM=7′ 11″÷2=3′ 11½″
Breadths on BG = 3
11′ 10½″
Half CM = −3 11½
3)7′ 11″=2⅝-d.

TRIANGLE ON FE.

Half FH =7′ 11″
Breadths on HE= 4
31′ 8″
Half FH = −7 11
3)23′ 9″=8 yds.

TRIANGLE ON DE.

Half DG = 5′ 11″
Breadths on GE= 6
35′ 6″
Half DG =−5 11
3)29′ 7″ =9⅞ yds.

TRIANGLE ON AF.

Half An =1′ 11″
Breadths on BH= 5
9′ 7″
Half An −1 11
3)7′ 8″=2½ yds.

Yards in rectangle =83¼
" " *triangles*=−23
" *on the floor* =60¼ net.

NOTE. If the bevels or slants are alike on any two opposite sides, so that the cut of end can be used in any of the triangles, then the area without the half length deducted is the number of yards in the triangle.

When the room is in the form of a circle.

Find the length of the several breadths by the following:

RULE 7

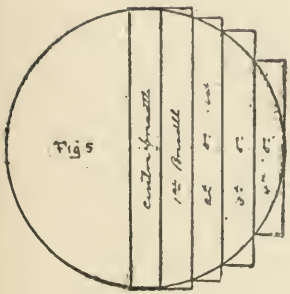


FIGURE 5

Take the difference between the square of the radius and the square of the number of breadths required less one, in feet and fractions thereof, counting from the center. The square root multiplied by two, is the length of the breadth sought.

To find the number of yards required:

Rule. To the length of the center breadth or breadths, which are always equal to the length of the diameter, add the length of the breadths found on each side.

Ex. 1. What is the length of the 2d, 3d, and 4th breadth from the center one, in a circular room (Fig. 5), radius= 10 ft.?

Second breadth=$2\sqrt{10^2-(3.4\frac{1}{2})^2}$=18.10.

Third breadth =$2\sqrt{10^2-(5.7\frac{1}{2})^2}$=16.6.

Fourth breadth=$2\sqrt{10^2-(7.10\frac{1}{2})^2}$=12.4.

Ex. 2. How many yards of $\frac{3}{4}$ plain carpet is required for a circular room, radius=10 feet as above?

Center breadth	=20′ 0″
First from center breadth	=20′ 0″
Second " " "	=18 10
Third " " "	=16 6
Fourth " " "	=12 4
	67′ 8″×2=135′ 4″
	155′ 4″

155′ 4″, or 51¾ yards net, is the number of yards required for the whole room.

Ex. 3. How many yards of ¾ plain Brussels does it require for a circular room (Fig. 6), radius=6′ 9″?

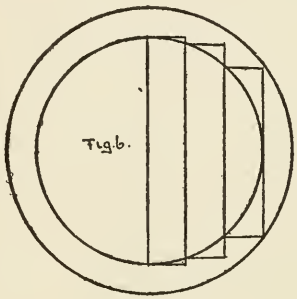


FIGURE 6.

1st breadth=diameter =13′ 6″
2d " $=2\sqrt{(6.9)^2-(2'\ 3'')^2}$=12 9
3d " $=2\sqrt{(6.9)^2-(4'\ 6'')^2}$=10 1

Number of yards on one side of the diameter=36′ 4″=12⅛ yards.
Number of yards on the other side = +36 4 =12⅛ yards.

And in the whole room=72′ 8″=24¼ yards, net.

Ex. 4. How many yards of ¾ body and ⅝ border are required for a circular room (Fig. 6), radius=8′ 7½″?

Radius, . . . = 8′ 7½″
Width of border, . . = −1 10½
Radius of circle inside the border, = 6′ 9″

Number of yards of ¾ carpet, . = 24¼. See *Ex.* 3.
Number of yards of ⅝ carpet, . = +18¼. See (5) the circle.
Total number of yards, . = 42½

No allowance made for matching either body or border.

The usefulness of the preceding rules will appear when applied in solving the following problems. By knowing the different methods, the most irregular floor can be accurately estimated with ease. In order to explain the work in full, it was necessary to write figures, which in general practice are mentally applied.

Ex. 1. How many yards of ¾ plain Brussels is required to cover a floor like Diag. 31? No allowance for matching.

BY THE SECOND METHOD

Explanation.

Drop on BC=11½″ for each foot or 2′ 2″ for each breadth. See *Rule* 1.

Drop on DE=12¼″ for each foot or 2′ 4″ for each breadth.

Beginning at the entrance side.

1st	breadth,				=	17′	6″
2d	"	=17′ 6″	+1′	11″	=	19	5
3d	"	=19 5	+2	2	=	21	7
4th	"	=21 7	+2	2	=	23	9
5th	"	=23 9	+	4	=	24	1
6th	"				=	24	1
7th	"				=	24	1
8th	"	=24 1	−	9	=	23	4
9th	"	=23 4	−2	4	=	21	0
10th	"	=21 4	−2	4	=	19	0
					=217′		10″
Deduct length of hearth,					= −7		0
					3)210′		10″
Number of yards net,					=	70½	nearly.

BY THE THIRD METHOD. RULE 5.

8th breadth	×24′ 0″	=192′ 0″
1st "		= 17 6
10th "		= 18 9
		228′ 3″
Triangle on BC	=5′ 0″	
" " DE	=5′ 0″	=− 17′ 0″
Length of hearth	=7′ 0″	
		3)211′ 3″
Number of yards,		70½ net.

Ex. 2. How many yards of ¾ plain carpet is required for room, Diag. 34?

Explanation. Figure from the entrance side, and begin by ascertaining the different lengths in the swell. *See Rule* 7.

The center is 11″ from the entrance side continued, the distance from the center to the second left breadth is, therefore, 2′ 3″+11″=3′ 2″, hence its length is $=2\sqrt{(5'\ 5'')^2-(3'\ 2'')^2}=9'\ 0''$. The distance from the center to the first breadth is 11″, therefore its length is $=2\sqrt{(5'\ 5'')^2-(11'')^2}=10'\ 6''$.

There are 3 breadths to the right of the entrance side running into the swell. The first of these is 14′ 3″+ 4′ 5″=18′ 8″ long; the second of these is 18′ 8″ long. The third breadth comes 4′ 6″−11″=3′ 7″ from the center, therefore its length is $5'\ 5''-\sqrt{(5'\ 5'')^2-(3'\ 4'')^2}=1'4''$ less than the second, or 17′ 4″. In triangle CED we have 14¼ yards. *See note on triangle, Rule* 4.

The estimate will then be, 1st short breadth = 9′ 0″

2d	"	"	=10 6
1st long		"	=18 8
2d	"	"	=18 8
3d	"	"	=17 4
		3)74′ 2″	=24¾ yards
In triangle CED			=+14¼ "
Number of yards, net			=39.0 "

Ex. 3. Estimate on Diag. 35 for ¾ plain carpet.

BY SECOND METHOD

Explanation. First find the length of the several breadths in the window. Second, find the drop on BC and CD.

Beginning at the entrance side, we notice that the first and fifth breadths in the window are short and the three center breadths run through. *First breadth* in window comes 6′ 0″ − 2′ 3″ from the center, therefore its length $=2\sqrt{(4'\ 5'')^2-(3'\ 9'')^2}=4'\ 7''$. *Second breadth* is 6′ 0″ − 4′ 6″ from the center, and its length $=\sqrt{(4'\ 5'')^2-(1'\ 6'')^2}$ + the difference between radius and depth of swell = 8′ 6″. *Third breadth* = 8′ 9″. *Fourth breadth* = 8′ 9″. *Fifth breadth* is 9′ 0″ − 6′ 0″ from the center, therefore its length $=2\sqrt{(4'\ 5'')^2-(3'\ 0'')^2}=6'\ 6''$.

Drop on BC = 3′ 7″ ÷ 3 = 1′ 3″ for each breadth.
Drop on DC = 11′ 0″ ÷ 6′ 5″ = 20⅝″ for each foot, or 3′ 11″ for each breadth.

1st breadth in room=	7′ 6″+1′ 3″	. . . . .	= 8′ 9″
1st " " window		. . . . .	= 4 7
2d " " room=	8′ 8″ +1′ 3″= 9′ 11″+2d b'dth in window		=18 5
3d " " " =	9′ 11″ +1′ 3″=11′ 2″+3d " " "		=19 11
4th " " " =11′	2″ − 8″=10′ 6″+4th " " "		=19 3
5th " " " =10′	6″ −3′ 11″= 6′ 7″	. . . .	= 6 6
5th " " window		. . . . .	= 6 6
6th " " room=	6′ 7″−3′ 11″	. . . . .	= 2 8
			3)86′ 11″
Number of yards, net		. . . . .	= 29

DIAGRAM 35. BY THIRD METHOD. RULE 6

6 breadths×11′ (length of room),		= 66′ 0″
3 " in window, 8′ 9″ long=	26′ 3″	
1 " " 4′ 7″ " =	4′ 7″	=+37 4
1 " " 6′ 6″ " =	6′ 6″	
		103′ 4″
Triangle on BC,	= 3′ 7″	
" " DC,	=11′ 1″	=−14 8
		3)88′ 8″

Number of yards net=29½ nearly. *

Estimate the above by rules 4 *and* 5.

Scale and estimate the following diagrams by these rules, using the different methods.

Diagrams 27, 36, 38, 40, and 43.

In the previous examples the carpets have been estimated without borders. To estimate on a carpet with a border, we first subtract twice the width of the border from the extreme length and width of the room, the remainder is the length and width of the space to be covered by the body of the carpet. The number of yards for this

* 2½ yards could be saved in this room by using waste for the 1st breadth in window and 6th breadth in room.

space having been found by the preceding methods, the distance around the room following wherever the outside of the border is to go, found by adding the lengths of the different sections of wall measured on the baseboard if the room is to be all covered, gives the yards of border required. To the sum of these two quantities there must be added the waste necessary to match the figure in the plain carpet and 9 inches for each miter as an allowance for seams and matching the miters in the border.

THE CIRCLE

To find the area, radius, diameter, or circumference of a circle, each from any other.

(1) 3.1416 times the square of the radius=area or . . $\pi R^2=A$

(2) 3.1416 times the square of the diameter divided by 4=area or . . . . . $\frac{\pi D^2}{4}=A$

(3) Circumference divided by 4 times 3.1416=area or . $\frac{C}{4\pi}=A$

(4) 3.1416 times the diameter=circumference or . . $\pi D=C$

(5) 3.1416 times twice the radius=circumference or . $2\pi R=C$

(6) Twice the square root of 3.1416 times the area=circumference or . . . . . $2\sqrt{\pi A}=C$

(7) Circumference divided by 3.1416=diameter or . $\frac{C}{\pi}=D$

(8) Twice the radius=diameter or . . . . . $2R=D$

(9) Twice the square root of the area divided by 3.1416=diameter or . . . . . $2\sqrt{\frac{A'}{\pi}}=D$

(10) Circumference divided by twice 3.1416=radius or . $\frac{C}{2\times 3.1416}=R$

(11) Square root of the area divided by 3.1416=radius or $\sqrt{\frac{A}{\pi}}=R$

(12) Half the diameter=radius . . . . . $\frac{D}{2}=R$

NOTE.—A is area; C is circumference; D is diameter; R is radius. The sign π is called P, and denotes the numerals 3.1416.

THE CIRCULAR ARC

How to find by calculation the chord or opening AB, the height DP, the chord AD of half the arc, the radius AC, and the arc ADB.

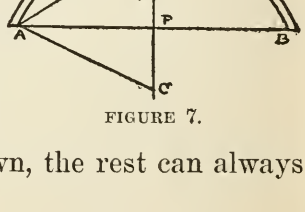


FIGURE 7.

By a well-known property of the right-angle triangle, namely, that the square of the longest side is equal to the squares of the two shorter added together, provided any two sides in the triangles ADP and APC are known, the rest can always be found.

(13) *Thus, if given* the radius and chord AB or its half AP. Then $\sqrt{AC^2-AP^2}=CP$ and $CD-CP=DP$; and $\sqrt{AP^2+PD^2}=AD$.

(14) *Again when* the radius and height PD are given, then $CD-DP=CP$; and $\sqrt{CA^2-CP^2}=AP$.

(15) *And when* AP and PD are given, then as $DP : PA :: PA : CD+CP=\frac{PA^2}{PD}$ and $2CD=\frac{PA^2}{PD}+PD$, and $\frac{\frac{PA^2}{PD}+PD}{2}=\text{Radius}$.

(16) *And when* AD and AB are given then $ADB=\frac{8AD-AB}{3}$.

THE ELLIPSE

To find the circumference of an ellipse.

(17) *Rule.* Multiply half the sum of the two diameters by 3.1416 and the product is the circumference nearly.

TO FIND THE AREA OF AN ELLIPSE

(18) *Rule.* Multiply the product of the two semi-axes by 3.1416 or multiply the product of the two diameters by .7854.

To show the usefulness of the above rules as appertaining to the carpet business we will take the following examples.

Ex. 1. How many feet of border are required to go around a circular room, radius of which is 5 feet?

$C=2\pi R=2\times 3.1416\times 5=31'\ 5''$, or $10\frac{1}{2}$ yards nearly.

Ex. 2. How much will a circular rubber mat cost at 50c. a square foot, diameter being 5 feet?

$$A=\frac{\pi D^2}{4}=\frac{3.1416\times 25}{4}=19.64$$ square feet and cost $9.82.

Ex. 3. The opening of a swell or circular window is 8 feet and the depth is 2 feet 6 inches. Find the radius.

$$\frac{\frac{PA^2}{PD}+PD}{2}=\frac{\frac{4\times 4}{2.6}+2.6}{2}=4'\ 5\tfrac{3}{8}''\text{ nearly.}$$

Ex. 4. How many yards of border are required to go around a circular window, Fig. 7, opening AB 16′ 0″ and depth DP=4′ 1″. We first find the chord AD=$\sqrt{AP^2+PD^2}=\sqrt{64+16.8}=9.0$. (13). Then ADB=$\frac{8AD-AB}{3}=\frac{8\times 9-16}{3}=\frac{56}{3}=18'\ 8''$ or $6\frac{1}{4}$ yards nearly. (16)

Ex. 5. How many yards of border are required to go around an elliptical-shaped room whose diameters are 24′ 9″ and 15′ 3″?

Long diameter=24′ 9″
Short " =15 3
Sum =40′ 0″÷2
Half sum =20′ 0″

3.1416
20
(17) 62.8320÷3=21 yards nearly.

Ex. 6. How many square feet in a mat of elliptical shape, diameters being 6 and 4 feet?

1*st method.* Half long diameter=3
Half short " =2 3.1416
Product =6 6
18.8496 sq. ft.

2*d method,* or 6×4=24; 24×.7854=18.8496 sq. ft.

FOR A CIRCLE. To find yards of border.

NOTE. When the diameter is 20 feet or less call it yards, and add one. When the diameter is more than 20 and less than 40 add two yards to the number of feet for yards, which will be near enough in practice.

A short method of finding the difference in quantity of carpet of different widths:

GENERAL RULE

1. Reduce the fractions to the same denomination.

2. If from the nature of the question, the answer should be more, place the greater of the two fractions on the right hand side of the smaller, but if it appear that the

answer should be less, place the greater fraction to the left of the smaller fraction.

3. Take the difference between the numerators and place it above the numerator on the left and cancel the denominator.

Ex. 1. If it requires 12 yards of ¼ carpet to cover a room, how much will it take of ¾ goods?

Of course, it will take more carpet to cover the room with the narrower goods if the carpet is sold by linear or running yards; the ¼ fraction will therefore be placed on the right (the smaller fraction always remaining stationary to better remember the rule). ¾, ¼. Now 3 from 4 (the two numerators) leave 1; place the 1 over the 3 and cancel or draw a line across the 4 thus $\frac{1}{\cancel{3}}$. Answer is then ⅓ more carpet of the ¾ width, and as ⅓ of 12 is 4, 4 added to 12 (the number of yards of ¼ goods), gives 16, the number of yards required.

Now let us reverse the question, using the same quantities.

If it requires 16 yards of ¾ wide carpet to cover a room how many yards will it take of ¼? This time it will take less carpet, therefore we place the larger or ¼ on the left and proceed as before: ¼, ¾. 4−3=1, $\frac{1}{\cancel{4}}$. Thus ¼ less is the answer. ¼ of 16 is 4 and 16—4 equals 12 (the number of yards of ¼ goods) as before. Thus it will be seen that in changing from ¼ to ¾ add ⅓ to the given number of yards. Changing from ¾ to ¼ subtract ¼ from the given number of yards.

If an order is received calling for an estimate on a quantity of carpet made up we will say of ¾ and ⅝ goods,

it may be required to figure the quantity on a basis of so much a square yard. First estimate the cost of ¾ goods required, then the cost of the border. Or, if the price of both are the same, get the cost of the whole carpet at once. Divide this sum by the number of square yards the floor contains and the quotient will be the cost of the carpet that will cover one square yard of floor space.

Ex. 1. A customer, undecided whether to have a parquette floor laid or use a carpet, wants to know how much more or less it will cost per square yard to cover a room 12′ 0″×15′ 0″, with ¾ carpet at $1.00 per yard and ⅝ border at .85 than to have a parquette floor at $1.75 a square yard.

We find that it takes 15 yards of ¾ goods at $1.00 per yard=$15.00, 18 yards of ⅝ goods at 85 cents=$15.30, making the carpet cost $30.30, and as the room contains 20 square yards of floor space it is evident that each square yard will cost $30.30÷20, or $1.52, to cover with the carpet; which makes it 23 cents less per sq. yard than the hardwood floor would cost.

Oilcloths and Linoleums

When estimating for oilcloths or linoleums the same rules will govern as when estimating for carpets in general, with the difference, however, that this kind of floor covering is usually made in patterns which will permit the cloth being cut without regard to top or bottom of figure. When the goods are made only in certain widths considerable waste will sometimes occur because the width of the cloth may be much more than the width of the room, and as seams lessen the wearing quality they

should be avoided as much as possible. As, however, the customer may want to economize for the time being, and only buy enough to cover the room regardless of seams, it is very important that the salesman when writing out the order should state what width of goods are kept in stock, also to emphasize, when quoting the price, that it is for the square yard, in order that there may be no misunderstanding in the customer's mind. Unless the measurer knows the width of the goods, he can neither estimate accurately, nor answer the customer intelligently, when suggestions as to cutting and piecing are requested. As most linoleums and oilcloths have geometrical designs it is often possible to economize by cutting the cloth enough longer than the room to utilize the waste in filling out the width and piece in jogs. If estimated this way a full memorandum of instructions should be made on the plan for the guidance of the cutter.

PART IX

HINTS ON MATCHING AND CUTTING CARPETS

It is not intended to treat at length the subject of carpet cutting. Nor is it necessary, owing to the fact that whereas the inexperienced measurer when doing his work is left to his own resources, the new cutter, after observing others, will always have available advice, and the foreman of the workroom who has full responsibility naturally expects to be consulted in all cases demanding special attention. As, however, questions may arise where a general knowledge of cutting and matching carpets would be required, a few hints on the subject will be given, and the inexperienced measurer should seize every opportunity to study the work done in the cutting room.

The cutter on receiving the plan should first carefully scrutinize it to make sure that all necessary measures are given, and when in doubt as to the correctness of the plan have the measures verified before proceeding further. Having received what appears to be a correct plan, the next step is to determine in which direction to run the breadths, with particular reference to figure, shading, and effect of sweeping on pile of fabric. Sometimes this question is decided by the customer, and, if so, the measurer has marked the plan accordingly with an arrow.

Otherwise it is left to the cutter's judgment. There are no set rules governing this point, consequently there exists among cutters some diversity of opinion as to the proper way of running the breadths and pointing the figures. Ninety-nine out of every hundred carpets which have come under the observation of the writer, and which have been cut by many different men, have given satisfaction by having the breadths and figures run as follows:

IN HALLS

Main halls if covered separately should have the breadths and figures run from the entrance. All halls above the first should have the breadths run the long way, top of figure pointing to the front, or toward the second stair if both are alike, or bottom of figure towards the first stair, as the case may be. A stair having one width only and showing an uncovered margin on each side, or if covered with an uncut pile carpet such as Brussels, Tapestry, etc., should have the figure point up always, unless the parlor, hall, and stair be alike, and the stair so situated as to spoil the effect on account of the figures running in an opposite direction, in which case the figure should run the same way as the parlor carpet. On a stair covered entire with a cut pile carpet, such as a Wilton, Axminster, etc., the carpet should be cut with the pile or nap running downwards regardless of the figure, and in this case if the main hall and stair are alike, with the breadths running in one direction and stair carpet showing from the front entrance, run hall carpet with figure pointing same as the figure on the stair.

FRONT ROOM

If the difference in length and width is slight run breadths to the front; if the difference is considerable, run breadths the long way, in any case, with the nap pointing towards the strongest light.

In front alcove rooms, the length of the room is determined regardless of the alcove, but of course the breadths in the alcove are run the same as in the room of which it is a part.

Back parlor and hall if connected with the parlor by large swinging or sliding doors and carpeted with the same pattern as the parlor, run breadths and design with the parlor carpet. In rooms adjoining parlor and connected with parlor by narrow doorways having sills, run breadths the same as in the parlor, but if the difference in length and width is considerable run it the long way of the room. When pile carpets are used, unless the difference in length and width of the room is very great, run breadths with pile towards the strongest light.

In rear rooms run breadths the long way with figures pointing towards the window if possible.

Having settled the above, we will now ascertain how many widths are required, on which side to have the selvage, and where short breadths or waste can be utilized. We will start by measuring the width of the goods, because frequently the goods may run under or over 27 inches and if many breadths are required $\frac{1}{8}$ of an inch would in the former case make the carpet fall short, and in the latter make the carpet cover a space which a regular 27-inch carpet might or might not cover.

The selvage side can be easily determined if we remember never to place cross-joins or piecings where they will be conspicuous, as in doorways or at the head or bottom of stairs. A stair which is to be covered entire requiring a part of a breadth, should have the piecing done on the wall side, and in rooms or halls, if any let-ins occur along the selvage side, like door or window recesses, run the selvage across, and cover with waste or short breadths, being particular, however, to have the pieces match.

We will next consider how to run it if the carpet has a border. There is perhaps no question of more importance to the carpet measurer, and as it is to the interest of all concerned that this matter should be settled at the house to the customer's satisfaction, by answering the following questions we can come to conclusions that should govern us in giving our opinions.

1. Why is the border made?

To give a finish to the carpet and by contrast bring out the harmony of design.

2. Will the carpet look as well without the border as with it?

In general no, sometimes yes; if by fitting the border around the room it has to be cut so as to mar the beauty of the pattern or if the space is so small that the border will predominate and give it a crowded and patched appearance, the carpet would look better perhaps without the border, although according to the answer of our first question it would certainly look better with it at least in the majority of rooms.

Does it take more yards by using the border? Yes, as the carpet and border alike are sold by the running yard,

and as most borders are narrower than the body, it follows that to cover a given space, more yards are needed with a border than without, the difference varying according to the size and shape of the room, width of border and length of pattern; the average difference when a $\frac{5}{8}$ border is used is about five yards; this ought not to be considered, however, if by using the border we add to the decorative value of the carpet, for, after all, the principal function of a floor covering is to give an air of comfort and refinement to a room.

Would it spoil the carpet for use in another room by having a border?

If a carpet is made to fit a room exactly the chances are very small of its fitting any other room without first being made over. Carpets as a rule are not put down to-day to be taken up to-morrow, and if the customer owns the house, the carpet may remain down for years, hence its appearance in that room should have first consideration. It is not necessary, however, to have the border follow the outline of the room in order to make the carpet look well, as it will look better frequently to have the border cut square. Indeed, the opportunity of making use of a square carpet with a border in another room is better than if the carpet had no border, as a filling which is always procurable can be used as a surround for the carpet, which is centered as a rug. A plain filling to match shade of carpet can always be procured, whereas often it is extremely difficult if not impossible to match the carpet with body or border of the same pattern. This is of special importance to persons living in flats or apartments and liable to move at any time.

From the above we may deduce the following rules: Show as much border as possible, but show body in proportion. Have border follow outlines of the room with as few miters as possible, recesses of less dimensions than the width of the border to be covered with the body carpet, or filling. Never stop a border unless it can be done and made to look finished.

We will next ascertain how much longer than the room the carpet will have to be cut in order to match. This is essential before cutting into the goods because the number of yards on ticket or stock book may seem sufficient, but owing to waste in matching the quantity may fall short of what is required to cover the space.

Starting from any prominent part of the pattern measure off the length of the room as shown on plan. The first repetition of this part of the figure beyond this length will be the cutting point, the difference representing the waste on that breadth. If, however, it should be difficult to detect the cutting point by studying a single breadth mark off the length of the room from the end of the breadth, then bring the end of the carpet up to this mark in such a way that the figures on both breadths will run in the same direction, move the end up until the figures match, or to a point where the figures come opposite. If it should waste too much on the left side try the right.

Sometimes the pattern is such that in order to match it more than one roll is required, but these designs are rare.

We can determine the cutting point by adding the length of the pattern a sufficient number of times to make the same equal or just exceed the length of the room, or,

in drop patterns, if the length of the figure is multiplied by a whole number, the product will show where the carpet cuts to a "set," as it is called, and multiplying by a fraction will show where it cuts to a match. Thus a 24-inch figure cuts to a set at 6, 8, 10 ft., etc., because $3\times2=6$, $4\times2=8$, $5\times2=10$, and so on. For the same reason it would cut to a match at 7, 9, and 11 ft. because $3\frac{1}{2}\times2=7$; $4\frac{1}{2}\times2=9$, $5\frac{1}{2}\times2=11$.

Having ascertained that there are sufficient goods strike out the plan, if the carpet is to be a border, or if the room is irregular. If several adjoining rooms are to be covered lay them out on the floor according to the plans, and arrange the breadths so that the figures in the several carpets will line with each other, and cut border so that if it has a conspicuous figure, it will be centered at the wall or window as the case may be. Match all miters as well as possible and those that can't be matched place in some obscure corner. If a border should come within a few inches of covering the width of the room use filling to match outside the border, if more than a few inches, it is safer to cut the carpet to fit (unless ordered otherwise by the customer) and use waste in doorways and window recesses if any.

Wiltons and velvets are cut down flat and are sewed together raw edge. Brussels and Tapestry borders are cut with an allowance of one inch, to be turned back on each side when sewed, unless made into rugs, when they also should be cut down flat. All carpets thus cut should have the seams covered with binding on the underside.

Axminster and Moquettes should be cut with an allowance of $1\frac{1}{2}$ inch, to be picked and turned under. And

as a matter of fact, to make a first-class job, all carpets surrounded by a border should have the surplus cut off and the raw edge hemmed or overcast. Moquettes and Axminsters should be plucked and hemmed to make a good seam and prevent raveling. Some cutters turn under this surplus on Brussels and Tapestries, but as the carpet rarely can be made any larger owing to the length of the border the only result of such turning under of waste is to furnish a refuge for moths. Turning under is also liable to show a ridge on the surface of the carpet when laid, and, the under part if used afterwards will contrast with the faded parts.

Cutting with a "drop" occurs when the pattern is such that to make a match and save waste the figure is dropped down one-half its length. To illustrate, suppose six breadths are required to make the carpet. After the cutting point is located cut three breadths through this figure, draw down the fourth breadth until it matches with the third. Cut off the "drop" or part extending beyond the third. Roll out this fourth breadth and cut it the same length as the three first, cut the remaining two, through the same figure and the same length as the fourth. Now, place the fifth breadth between the second and third, and the first in the place left by the fifth, and the carpet is matched. If the carpet requires an odd number of say five breadths, cut the first two to a set, drop down the third, cut off the waste, make the fourth and fifth breadth the same length and cut through the same figure as the third; now let the first and fourth breadths change places, and the whole carpet will match. Try the inside end of the roll before cutting off the "drop," as it

may save this waste. And when an odd number of breadths are used cut the lesser number first, as that may permit a saving on the last breadth.

All carpets after being sewed should have the seams thoroughly pressed on the back; if any fullness appears it may be taken out by the application of a wet cloth and hot iron. The carpet should now be inspected by the cutter, who will thus make sure that filling or piecings are properly placed, and that the carpet is otherwise all right before it leaves the store.

Carpets made in rug shape should be stretched face down on the cutting floor and tacked to chalk lines previously laid out to represent the desired size of the rug. It is then ready for the shrinking and sizing process, which consists of sprinkling the carpet with a solution of water and sizing, vigorously rubbing it with a broom, after which it is left to dry. Be careful not to sprinkle too much, as it may saturate and soil the surface. Care should also be taken not to wet the end borders too much, which would cause the corners to be drawn out of square for the reason that the border will not shrink as much in the width as it will in the length. All carpets similarly treated should be shipped rolled around a pole face out.

PART X

FLOOR COVERINGS

The following article is written for the benefit of those not familiar with the different varieties of carpets at present in the American market. For a complete treatise on this subject the reader is referred to the "History and Manufacture of Carpets," issued by the Review Publishing Company, New York City.

The principal varieties of carpets sold and named in order according to their grade are as follows:

Oriental Carpets.

Savonneries and Aubusson.

Hand-made and Chenille Axminsters.

Wiltons and Body Brussels.

Machine-made Axminsters and Moquettes.

Velvets and Tapestries.

Woollens (as all Ingrain carpets are called by the trade) and Venetians.

The Oriental Carpets and Rugs may be divided into three general classes—Turkish, Persian, and Indian. These again are subdivided into different varieties, each generally taking its name from the province or district where made. Thus among the makes or weaves classed as Turkish are: Ghiordez, Demerdji, Gulistan, Oushak, Karabajh, Kazak, Kurdistan, Bergamo, Mossuls, Der-

bends, Daghestans, Shirvans, and Anatolians. Bokharas, Khivas, Guendjes, Samarkand, and Soumak, the last five being Turkoman weaves. Among the best known Persians are the Ferajhan, Sultanabad, Muskabad, Gorovan, Tabriz, Kermanshah, Saruk, Meshed, Bijar, Serebend, Sheraz, Senna, Khorassan and Herez, the last five being made in small sizes. And among the Indian rugs are such names as Mirzapore, Masulipitan, Amritzar, Lahore, Hydarabad, and Pushmina. As the makes are so numerous it requires a great amount of study and handling of these goods to get thoroughly acquainted with the different qualities and makes. They are all made in one piece, usually with a linen or hemp warp and filling, and a pile consisting of tufts of colored wool knotted around the warp by the weaver's fingers.

Savonnerie is a French carpet woven in one piece on a high warp tapestry loom, the warp being of wool and the weft of worsted threads, which are fastened by a double knot on two threads of the warp.

Aubusson is also a French carpet made on a tapestry handloom. The warp is cotton and the weft consists of woolen yarns of the colors called for by the design. The weft yarns are inserted in the warp by hand, the weaver using a small bobbin in doing so.

Hand-made Axminsters have a warp of linen threads with a pile of woolen tufts tied in by hand in Oriental fashion.

The Chenille Axminster has a thick groundwork upon which the woolen pile, previously formed into threads resembling chenille, is woven to and fro across the groundwork, and fastened upon it by threads of warp; it has a

cut or velvet pile. They are like the above mentioned carpets, very elegant and quite expensive.

The Wilton, next in grade, is probably the most enduring of all machine-made carpets. These are woven with a thick, firm worsted pile upon, or rather, intermingling with, a linen back. The worsted is entirely in the warp and is woven over wires running across the breadths, forming the pile in rows of loops; as the wires, which have a sharp, knife-like edge, are withdrawn the loops are cut, leaving a velvet surface. Each color is represented by threads of warp running the entire length of the web and as they cease to be required on the surface they are dropped and carried along in the warp, showing the worsted on the back until again needed by the design on the surface. The warp threads are wound on reels arranged on horizontal frames placed one above the other back of the loom, each reel supplies one thread, and each frame 260, this being the number in a 27-inch carpet. The number of frames rarely exceeds five, never more than six, the quality of carpet depending on the number of frames employed and is determined by the number of colors showing in a straight line lengthwise in the carpet. Thus three-, four-, and five-frame Wilton and Brussels.

The Brussels is woven with the pile in loops and the worsted showing on the back, in the same manner as the Wilton, except that the pile is not quite so thick and close, about fifty per cent. less yarn being used. The loops remain uncut, the wires having a round instead of a sharp edge.

Machine-made Axminsters and Moquettes have a cotton

warp, cut worsted pile, and weft of hemp, forming the back, and binder for the tufts.

The yarn composing the pile is wound on spools and carried to the warp by an endless chain. The threads are then grasped by a series of nippers drawn out and around the binding or tufting thread, after which the heddles are operated and the threads cut by two steel blades, thus forming the tufts.

These carpets are known by different names, as Savonnerie, Saxony, etc. The method of manufacture being essentially the same, differing in the number of tufts to the inch, the Savonnerie having the tuft threads woven side by side, whereas in the Saxony the tuft or binding threads are separated by a filler of hemp.

The Velvet or Wilton Velvet have a very similar pile to the Wilton, though there is usually a greater variety of colors and a freer handling of design and shading. This is because of the different manner of construction. The pattern being first printed on the yarn warp, thread by thread, then woven on a backing of hemp or jute yarn, a cotton chain and a linen or cotton weft, which serves as a binder for the loops. The velvet surface is obtained by weaving the worsted warp over wires which when withdrawn cut the loops as in the weaving of Wiltons. The worsted does not show at all on the back, and thus it can easily be distinguished from the Wilton, though to the initiated a glance at the surface is sufficient for this purpose.

Tapestry or Tapestry Brussels are made the same as Velvets excepting that the loops are left uncut as in Brussels carpets. It is distinguished from Brussels by the

greater variety of colors in the design and by not showing any worsted on the back. These carpets are graded according to the number of warp threads in the width of the fabric, this number varying in 27-inch goods from about 180 in the low grade to 216 in the 10-wire carpets, thus 10-, 9-, 8-wire Tapestry and Velvets. These carpets are also made by weaving the worsted warp undyed or in a uniform basic color, after which the pile, cut or uncut, is submitted to a color-printing machine, where rollers, one for each color, and engraved according to pattern, impress the desired design.

The Woolens comprise all the Ingrains carpets, such as the three-plies, two-plies, and all the plain and unfigured carpets. The three-plies are made of three separate layers or thicknesses ingrained together. The two-piles used to be called by various names, as Ingrains, Kidderminsters, Extra Superfines, etc., all meaning the same thing, are composed of two layers or plies, and are usually woven harder and more thoroughly ingrained than the three-plies. The more general this ingraining or mixing up of the plies, the more durable the fabric will be; thus a design showing large masses of unmingled color will not wear as well as though thoroughly ingrained or interwoven with the plies beneath it. Both sides of these carpets are equally serviceable, only the colors are reversed.

The plain or unfigured woolens, usually called fillings, are mostly used for groundwork on which to spread rugs, or as a surround or filling on a floor partly covered by a rug or carpet.

Venetian carpets are made with a worsted or cotton

warp and jute filling. The warp is colored and makes the figure effect. These carpets are used mostly for stairs and halls.

Other floor coverings are the Mattings of China and Japan, American-made Matting, known as Prairie or Crex Matting. The Cocoa or Coir Matting, Oilcloths, and Linoleums.

In the China Matting the warp is hemp, the weft of straw, is generally woven in check patterns.

The warp of the *Japanese Matting* is of cotton, the straw used for the weft finer, and the design more elaborate than in the Chinese Matting.

The Prairie Matting consists of a coarse grass weft and a cotton warp; this matting is made in different widths, and in striped or plain designs.

Cocoa or Coir Mattings are made entire from the fiber or husk of the cocoanut. These mattings are manufactured by the natives in the countries where the cocoanut palm grows; in America from imported fiber. These goods also come in different widths.

Oilcloths consist of a burlap foundation heavily treated to a sizing of liquid glue, rye flour, tapioca, or varnish. One side is then covered with a mixture composed of ocher, linseed oil, and benzine, the quality of cloth depending on the number of coats thus received. When dry it is rubbed smooth and submitted to a machine which prints the pattern.

Linoleums are similar to oilcloths, though not so glossy, but softer and less noisy to walk over. They are made from a mixture of boiled linseed oil, cauri gum, resin, and ground cork, rolled on a jute burlap foundation. The

method of printing the pattern is almost similar to the process employed in printing oilcloths.

In the making of *Inlaid Linoleums* the different parts of the pattern are formed and colored separately; they are then arranged according to design on a burlap backing and a pressure applied until the coating and burlap are thoroughly united, thus the pattern goes clear through to the backing.

Interlock is another species of floor covering; it is composed of rubber blocks and derives its name from the manner these blocks are joined together. Each block representing the whole or part of a pattern is dovetailed or locked together when laid. It is about $\frac{1}{4}$ inch in thickness, very expensive but almost indestructible.

PART XI

SUGGESTIONS TO THE LAYER

On the carpet layer depends to a certain degree the successful termination of the measurer's and cutter's skill.

To him is entrusted the completion of the work, and the possibility of having an otherwise perfect job spoiled, by a careless or incompetent layer, is sufficient reason for the following few remarks.

Before attempting to lay the carpet, the room should be cleared as far as possible of all movable furniture, after which a careful inspection should be made of the floor to make sure no loose tacks or other small objects remain, which would cause unevenness on the surface after the carpet is laid.

The entire carpet should now be spread on the floor, and the correct position of filling or piecings for recesses or jogs (if any) verified. Should there be any error caused by the measurer, cutter, or otherwise, which can be easily remedied by the layer, he should quietly rectify the same before proceeding further.

The carpet being all right the lining is now spread in the following manner: Turn back a part of the carpet as far as possible, first, at the two corners (taking one at a time), then at the middle, thus exposing a part of the floor

upon which to spread as many strips of lining as the space will allow. Carefully return the carpet to its first position and repeat the operation on the other side or end of the room. By handling the carpet as described above, the chance of disturbing or wrinkling the lining, which would result if the whole carpet was dragged over it, is thus avoided.

If the carpet is plain, *i. e.*, without a border, it should if possible be laid from the front and entrance side of the room, for the reason that these parts are usually the most conspicuous and less liable to be covered with furniture. It is therefore desirable to have the figures line up straight at these parts of the room; this result would be hard to obtain in some carpets if the start was made at the rear and the carpet stretched towards the front. Be careful, when turning under the carpet, to follow the same figure or line of pile.

Of course, if all the recesses are at the rear wall, the carpet considerably longer than the room, and the customer desire the waste left on, it will save time, and cutting into the carpet, by starting to lay at the rear, and have the turn-under at the front. If good workmanship is paramount, however, the surplus should be cut off and only a few inches allowed for a turn-under. Bordered carpets in rooms with bay or swell windows should invariably have the bay or swell laid first, for if the carpet is cut tight it will be found extremely difficult to put these parts in after the rest of the carpet has been stretched.

Stair runners should be laid from the bottom by driving a tack at each selvage as the work progresses, until the top

is reached. Now straighten by line of pile and tack the upper end securely, then work down by driving tacks between the selvages on the tread at bottom of riser; this will thoroughly stretch the carpet, besides being the most expeditious way. If it is a winding stair, the wind or elbow part will have to be treated separately.

Oilcloth and linoleum should be cut larger than the space for which it is intended; it should be spread and cut to fit in the space itself, as you cannot accomplish this with success by measurement. It should be spread so as to lie perfectly smooth, naturally, as it cannot be forced.

To obtain the best results these goods should be spread on the floor of the cutting room for a few days after being cut, and at the time of laying it should be trimmed so as to leave $\frac{1}{8}$ of an inch margin all around; this gives the goods the necessary chance to expand. Use no tacks on oilcloths at time of laying or at any other time, unless it becomes necessary to tack the seam.

Sometimes the ends are inclined to roll at the baseboard or in front of doors, this may be prevented by driving small tacks temporarily into the base or sill, or by tacking a narrow strip of oilcloth on the edge of the sill; this will allow the cloth to work under as it expands. The seams of linoleums may be cemented or bradded when laid, otherwise treat same as oilcloth.

To lay mattings properly is more difficult than is generally supposed. In irregular spaces, tower or bay windows, straight seams can only be had by free use of the chalk line.

Mattings are mostly laid with the knee-stretcher, except in long spaces, or where the center is full; in such cases

the vise can be used to better advantage, as by this tool the strain can be made gradual, whereas the jerk produced by the knee-stretcher would in many cases break the warp.

If the matting is to be laid over lining, it will be advantageous to spread the lining the opposite way of the matting; where this is not convenient, it should be laid by starting with a half width of lining, so that the seams of the lining and matting will not come over each other, as this will sometimes cause trouble, being too bulky for the double-pointed tacks.

As only few rooms require just even widths, it becomes necessary to split a width to fit; this can be accurately done, no matter how irregular the baseboard is, by turning this breadth face down, pushing the selvage up against the baseboard, and using the selvage of the last breadth laid, as a straight edge; this can easily be followed with the shears, and with a little practice the required and exact fitting width is thus produced; in turning the cut piece face up the raw edge will come next the baseboard and should be finished by tacking a narrow binding on, to prevent fraying when sweeping.

China matting can be joined by pulling out the fiber until the ends of the warp are about two inches long, then turn the warp ends under and drive a double-pointed tack over each; place the other end similarly prepared close to the first and tack in the same manner. This makes a neat and substantial join.

Fine matting should be tacked the same way without pulling out the fiber. On a slanting or circular base where matting cannot be turned under, double-pointed

tacks should always be driven on the warp, as these are much more effective in holding the strain than ordinary tacks. After the carpet is laid remove all scraps or pieces of carpet and lining, be careful not to leave any loose tacks scattered around the carpet, window sills, or furniture.

If the parties concerned are present they should be asked to inspect the work and see if everything is satisfactory. If any fault is found as to quality, shading, waste, etc., over which the carpet layer has no control, he should politely inform the customer that the store is the proper place to make all complaints. The layer by being pleasant and accommodating will frequently cause the customer to overlook minor faults.

Note. When handling oilcloths and linoleums great care should be taken not to break the surface, especially in cold weather when the cloth is chilled, as it is then very brittle. It should therefore be left in a warm room, away from registers and stoves, a few days before being laid. A printed notice containing this warning should be pasted on the outside of each roll.

PART XII

TO MEASURE FOR SHADES, DRAPERIES, AND AWNINGS

This work, although belonging to a different part of the house-furnishing business, may be considered as coming within the field of the carpet measurer. Inasmuch as he is frequently called on to take such measures, considerable expense can be saved both dealer and customer by having one man measure for the carpets, shades, awnings, and draperies; and where no special work of the draper's art or awning man's skill is required, such measures, if taken accurately and according to the following rules, will be sufficient for all purposes.

Shades are either placed on the casing, on the stop-bead, or in the run of the window over the pulley. This last place is recommended, as shades so placed will not interfere with the hanging of draperies, and serve their purpose equally well. If double shades are required they can be placed one over the other in double brackets, unless, as is sometimes the case, the window frames are set in beyond the outside casing, in which case the second shade can be hung between the jambs. If window screens are so placed as to interfere with the workings of an inside shade, the brackets must be placed either on the casing or on the stop-bead, but no fixed rule can be given and in the absence of specific instructions from the customer the measurer will have to use his own discre-

tion. To measure for shades use either tapeline or rule. If tape is correct, which can easily be ascertained by comparing it with a rule, its use has the advantage of not being limited to one or two places on which to take the measure, as is the case when the rule is used, and the possibility of errors is minimized because no adding of lengths is necessary. Hold the ring of the tape against the stile of the window with the thumb of one hand, carry the tape to the opposite between the thumb and forefinger of the other hand, moving it up and down until the nail of thumb or forefinger just touches the stile. Take very exact measures for inside and stop-bead shades. If the window is wider than the spread of your arms fasten the tape with your awl.

For length, measure from the top of lower sash to sill, and double your tape, or if the two sashes are of different lengths, measure height of window between casings. Outside shades should be measured so as to place the bracket on a flat surface, and from one to two inches from stop-bead; give the exact length of the shade from bracket to sill, and let cutter make allowance for trimming, hem, and extra length.

To Measure for Laces and Draperies

Make a floor plan of each room, suite or story, with drawings of doors and windows to be decorated. Well-defined outline sketches are all that is needed. The following measures will enable the drapery cutter to produce plans to scale from which almost any drapery can be cut: Width between stop-beads, height of window between casings, width of casing, length of window from

top of casing to sill and floor, projection of casing from wall (return), and height of room. If a bay, give distance of window from corners. If a swell, give distance between windows, together with such measures as are required for circular or elliptical window (see diagrams).

To Measure for any Ordinary Curtain, with pole or cornice, in the usual place across top of casing, only three measurements are required, viz.: across the width of casing at top, from top of casing to floor, and projection of casing from wall. (Return.)

For "French" or "Glass" Curtains, give width between stop-beads and length between casings. For sash curtains, give width between stop-beads and length, three-fourths (¾), or the whole of the lower sash.

To Measure for Portieres

If portiéres are to be hung outside on the casing, measure width of the whole casing or frame and length from top of casing to floor. If inside, measure width of opening between jambs and height of opening from floor.

To Measure an Archway

Measure the width where the pole is to be placed, then from crown of arch to floor and from spring of arch to floor. If a pole is to be fitted around the inside, or cornice, to go outside, or a frame of any kind to fit the form of arch, take a paper pattern of the space.

If the opening is too large for a pattern to be taken, and it is not a segment of a circle enabling it to be laid out by finding the radius, proceed as follows:

Make a sketch of the opening to be measured, snap a chalk line on the floor across the space and measure the width of it on the floor. Draw marks across chalk line every foot, beginning at the center and working both ways. Fasten the end of your tape to the side of the arch and only at such a distance from the floor that when stretched taut and parallel to the floor the marks on the tape will be directly over the corresponding marks on the chalk line. The further the lines are apart the better.

Fasten the tape in this position with tack or awl. Now get two straight sticks or rods of such length that the two combined will be longer than the distance from the floor to highest part of arch. Place end of rod on center mark on chalk line and hold it up perpendicular so it will traverse the tape at the corresponding mark, hold the second rod on the first, with edges touching the marks even, and move it up in contact with arch. Grasp the two rods firmly and lay them on the tape for length. Proceed in like manner across every foot mark on tape, and record measure on sketch. (See Diag. 48.) In this manner one man can do the work without steps or ladder. The height of any room can be measured in this way if sufficiently long sticks can be obtained.

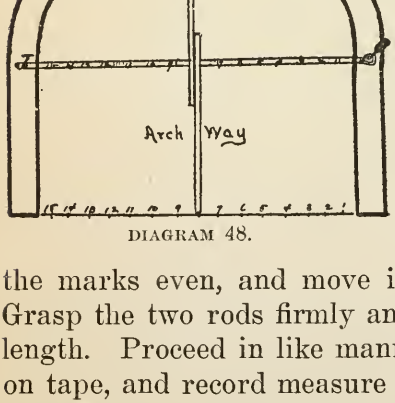


DIAGRAM 48.

AWNINGS

The usual way of placing awnings is to fasten them on the outside of the frame from one-half to one inch from the opening of the window, and, where there are blinds, so arranged that they can be left on if desired. The custom as to length varies in different sections of the country. In some cities the awnings are made to come so low that the ends of the frame almost touch the window sill, while in other places the rule is to have the ends of the frame fastened 3 inches below the upper half of the window. In the former case the frame is made to slide on rods fastened to the wall, so that when the awning is up, the frame will fit close under the top of the window. In the latter case the ends of the frame are hinged to the window frame at a distance from the top of the window equal to the projection of the frame.

The rods are also used if the projection of the frame from the wall is greater than one-half the space, as in the case where the awning is to be made as a canopy over a door, and to raise the iron frame would bring its top too high; the rods thus serve as guides for the ends of the frame to slide on, bringing the top of the frame even with the top of the space. Made in that way lines must be attached to the ends of the frame and passed through pulleys above, in order to raise the ends of the frame into place when the awning is in use.

In either case only three measures are required, viz., the greatest width of the opening, the length from top of opening to where the frame is to rest when the awning is in use, and the whole length of the opening.

Should the window be arched at the top take a paper

pattern, or take measures as in the previous article on how to measure an archway. A door awning projecting over a flight of stairs can be placed quite low down on the door frame, provided it projects far enough to allow a person ascending the steps to enter without interference.

PART XIII

TABLE OF CUTTING LENGTHS.

Length of Figure in Inches.

Character of Pattern.	12″	13″	14″	15″	16″	17″	18″	19″	20″	21″	22″	23″	24″	25″
S...	9.0	8.8	9.4	8.9	9.4	8.6	9.0	9.6	8.4	8.9	9.2	9.7	8.0	8.4
M..	9.6	9.2½	9.11	9.4½	10.0	9.2½	9.9	10.3½	9 2	9.7½	10.1	10.6½	9.0	9.4½
S...	10.0	9.9	10.6	10.0	10.8	9.11	10.6	11.1	10.0	10.6	11.0	11.6	10.0	10.5
M..	10 6	10.3½	11.1	10.7½	11.4	10.7½	11.3	11.10½	10.10	11.4½	11.11	12.5½	11.0	11.5½
S...	11.0	10.10	11.8	11.3	12 0	11.4	12.0	12.8	11.8	12.3	12.10	13.5	12.0	12.6
M..	11.6	11.4½	12.3	11.10½	12 8	12 0½	12.9	13.5½	12.6	13.1½	13.9	14.4½	13 0	13 6½
S...	12.0	11.11	12.10	12.6	13.4	12.9	13.6	14.3	13.4	14.0	14.8	15.4	14.0	14 7
M..	12.6	12.5½	13.5	13.1½	14.0	13.5½	14.3	15.0½	14.2	14.10½	15.7	16.3½	15.0	15.7½
S...	13 0	13 0	14.0	13 9	14.8	14.2	15.0	15.10	15.0	15.9	16.6	17.3	16.0	16.8
M..	13 6	13.6½	14.7	14.4½	15.4	14.10½	15.9	16.7½	15.10	16.7½	17.5	18.2½	17.0	17.8½
S...	14.0	14.1	15.2	15 0	16.0	15.7	16 6	17.5	16.8	17.6	18.4	19 2	18.0	18.9
M..	14.6	14.7½	15.9	15.7½	16.8	16.3½	17.3	18 2½	17.6	18.4½	19.3	20.1½	19.0	19.9½
S...	15.0	15.2	16.4	16.3	17.4	17.0	18.0	19 0	18.4	19.3	20.2	21.1	20.0	20.10
M..	15.6	15.8½	16.11	16.10½	18.0	17.8½	18.9	19.9½	19.2	20.1½	21.1	22.0½	21.0	21.10½
S...	16.0	16 3	17.6	17.6	18.8	18.5	19 6	20.7	20.0	21.0	22.0	23.0	22.0	22.11
M..	16.6	16.9½	18.1	18.1½	19.4	19.1½	20.3	21.4½	20.10	21.10½	22.11	23.11½	23.0	23.11½
S...	17.0	17.4	18.8	18.9	20.0	19.10	21.0	22.2	21.8	22.9	23.10	24.11	24.0	25.0
M..	17.6	17.10½	19.3	19.4½	20.8	20.6½	21.9	22.11½	22.6	23.7½	24.9	25.10½	25.0	26.0½
S...	18.0	18.5	19.10	20.0	21.4	21.3	22.6	23.9	23.4	24.6	25.8	26.10	26.0	27.1
M..	18.6	18.11½	20.5	20.7½	22.0	21.11½	23.3	24.6½	24.2	25.4½	26.7	27.9½	27.0	28.1½
S...	19 0	19.6	21.0	21.3	22.8	22.8	24.0	25.4	25.0	26.3	27.6	28.9	28.0	29.2
M..	19.6	20.0½	21.7	21.10½	23.4	23.4½	24.9	26.1½	25.10	27.1½	28.5	29.8½	29.0	30.2½
S...	20.0	20.7	22.2	22.6	24.0	24.1	25.6	26.11	26.8	28.0	29.4	30.8	30.0	31.3
M..	20.6	21.1½	22.9	23.1½	24.8	24.9½	26.3	27.8½	27.6	28.10½	30.3	31.7½	31.0	32.3½
S...	21.0	21.8	23.4	23.9	25.4	25.6	27.0	28.6	28.4	29.9	31.2	32 7	32.0	33.4
M..	21.6	22.2½	23.11	24.4½	26.0	26.2½	27 9	29 3½	29.2	30.7½	32.1	33.6½	33.0	34.4½

TABLE OF CUTTING LENGTHS.

Length of Figure in Inches.

Character of Pattern.	26″	27″	28″	29″	30″	31″	32″	33″	34″	35″	36″	37″	38″	39″
S...	8.8	9.0	9.4	9.8	10.0	7.9	8.0	8.3	8.6	8.9	9.0	9.3	9.6	9.9
M..	9.9	10.1½	10.6	10.10½	11.3	9.0½	9.4	9.7½	9.11	10.2½	10.6	10.9½	11.1	11.4½
S...	10.10	11.3	11.8	12.1	12.6	10.4	10.8	11.0	11.4	11.8	12.0	12.4	12.8	13.0
M..	11.11	12.4½	12.10	13.3½	13.9	11.7½	12.0	12.4½	12.9	13.1½	13.6	13.10½	14.3	14.7½
S...	13.0	13.6	14.0	14.6	15.0	12.11	13.4	13.9	14.2	14.7	15.0	15.5	15.10	16.3
M..	14.1	14.7½	15.2	15.8½	16.3	14.2½	14.8	15.1½	15.7	16.0½	16.6	16.11½	17.5	17.10½
S...	15.2	15.9	16.4	16.11	17.6	15.6	16.0	16.6	17.0	17.6	18.0	18 6	19.0	19.6
M..	16.3	16.10½	17.6	18.1½	18.9	16.9½	17.4	17.10½	18.5	18.11½	19.6	20.0½	20.7	21.1½
S...	17.4	18.0	18.8	19.4	20.0	18.1	18.8	19.3	19.10	20.5	21.0	21.7	22.2	22 9
M..	18.5	19.1½	19.10	20.6½	21.3	19.4½	20.0	20.7½	21.3	21.10½	22.6	23.1½	23.9	24.4½
S...	19.6	20.3	21.0	21.9	22.6	20.8	21.4	22.0	22.8	23.4	24.0	24.8	25.4	26.0
M..	20.7	21.4½	22.2	22.11½	23.9	21.11½	22.8	23.4½	24.1	24.9½	25.6	26.2½	26.11	27.7½
S...	21.8	22.6	23.4	24.2	25.0	23.3	24.0	24.9	25.6	26.3	27.0	27.9	28.6	29.3
M..	22.9	23.7½	24.6	25.4½	26.3	24.6½	25.4	26.1½	26.11	27.8½	28.6	29.3½	30.1	30.10½
S...	23.10	24 9	25 8	26.7	27.6	25.10	26 8	27.6	28.4	29.2	30.0	30.10	31.8	32.6
M..	24.11	25.10½	26 10	27.9½	28.9	27.1½	28.0	28.10½	29.9	30.7½	31.6	32.4½	33.3	34.1½
S...	26.0	27.0	28.0	29.0	30.0	28.5	29.4	30.3	31.2	32.1	33.0	33.11	34.10	35.9
M..	27.1	28.1½	29.2	30.2½	31.3	29.8½	30.8	31.7½	32.7	33.6½	34.6	35.5½	36.5	37.4½
S...	28.2	29.3	30.4	31.5	32.6	31.0	32.0	33.0	34.0	35.0	36.0	37.0	38.0	39.0
M..	29.3	30.4½	31.6	32.7½	33.9	32.3½	33.4	34.4½	35.5	36.5½	37.6	38.6½	39.7	40.7½
S...	30.4	31.6	32.8	33.10	35.0	33.7	34.8	35.9	36.10	37.11	39.0	40.1	41.2	42.3
M..	31.5	32.7½	33.10	35.0½	36.3	34.10½	36.0	37.1½	38.3	39.4½	40.6	41.7½	42.9	43.10½
S...	32 6	33.9	35.0	36.3	37.6	36.2	37.4	38.6	39.8	40.10	42.0	43.2	44.4	45.6
M..	33.7	34.10½	36.2	37.5½	38.9	37.5½	38.8	39.10½	41.1	42.3½	43.6	44.8½	45.11	47.1½
S...	34.8	36.0	37.4	38.8	40.0	38.9	40.0	41.3	42.6	43.9	45.0	46.3	47.6	48.9
M..	35.9	37.1½	38.6	39.10½	41.3	40.0½	41.4	42.7½	43.11	45.2½	46.6	47.9½	49.1	50.4½

TABLE OF CUTTING LENGTHS.

Length of Figure in Inches.

Character of Pattern.	40″	41″	42″	43″	44″	45″	46″	47″	48″	49″	50″	51″	52″	53″
S...	10.0	10.3	10.6	7 2	7.4	7.6	7.8	7.10	8.0	8 2	8.4	8.6	8 8	8.10
M..	11.8	11.11½	12.3	8.11½	9.2	9.4½	9.7	9.9½	10.0	10.2½	10.5	10.7½	10.10	11.0½
S...	13.4	13.8	14.0	10.9	11.0	11.3	11.6	11.9	12.0	12.3	12.6	12.9	13.0	13.3
M..	15.0	15.4½	15.9	12.6½	12.10	13.1½	13.5	13 8½	14 0	14.3½	14.7	14.10½	15.2	15.5½
S ..	16.8	17.1	17.6	14.4	14.8	15.0	15.4	15.8	16.0	16.4	16.8	17.0	17.4	17.8
M..	18.4	18.9½	19.3	16.1½	16.6	16.10½	17.3	17.7½	18.0	18.4½	18.9	19.1½	19.6	19.10½
S...	20.0	20.6	21.0	17.11	18.4	18.9	19.2	19.7	20.0	20.5	20.10	21.3	21.8	22.1
M..	21.8	22.2½	22.9	19 8½	20 2	20.7½	21.1	21.6½	22.0	22.5½	22.11	23.4½	23.10	24.3½
S...	23.4	23.11	24.6	21.6	22 0	22.6	23.0	23.6	24.0	24.6	25.0	25.6	26.0	26 6
M..	25.0	25.7½	26.3	23 3½	23.10	24.4½	24.11	25.5½	26.0	26 6½	27.1	27.7½	28.2	28.8½
S...	26.8	27.4	28.0	25 1	25.8	26.3	26.10	27.5	28.0	28.7	29.2	29 9	30.4	30.11
M..	28.4	29.0½	29.9	26.10½	27.6	28.1½	28.9	29.4½	30.0	30.7½	31.3	31.10½	32.6	33.1½
S...	30.0	30.9	31.6	28.8	29.4	30.0	30.8	31.4	32.0	32.8	33.4	34 0	34.8	35.4
M..	31.8	32.5½	33.3	30.5½	31.2	31.10½	32.7	33.3½	34.0	34.8½	35.5	36.1½	36.10	37.6½
S...	33.4	34 2	35.0	32.3	33 0	33.9	34 6	35.3	36.0	36.9	37.6	38.3	39.0	39.9
M..	35.0	35.10½	36 9	34 0½	34.10	35.7½	36 5	37.2½	38 0	38 9½	39.7	40.4½	41.2	41.11½
S...	36.8	37.7	38.6	35.10	36 8	37.6	38 4	39.2	40.0	40 10	41.8	42.6	43.4	44.2
M..	38.4	39.3½	40.3	37.7½	38.6	39.4½	40.3	41.1½	42.0	42.10½	43.9	44.7½	45.6	46.4½
S...	40.0	41.0	42.0	39 5	40.4	41.3	42.2	43.1	44.0	44.11	45.10	46.9	47.8	48.7
M..	41.8	42.8½	43.9	41.2½	42.2	43.1½	44.1	45.0½	46.0	46 11½	47.11	48.10½	49.10	50.9½
S...	43.4	44.5	45.6	43.0	44.0	45.0	46.0	47.0	48 0	49 0	50.0	51.0	52.0	53.0
M..	45.0	46.1½	47.3	44 9½	45.10	46.10½	47.11	48.11½	50.0	51.0½	52.1	53.1½	54.2	55.2½
S...	46.8	47.10	49.0	46.7	47.8	48 9	49.10	50.11	52.0	53.1	54 2	55.3	56.4	57.5
M..	48.4	49.6½	50.9	48.4½	49.6	50.7½	51 9	52.10½	54.0	55.1½	56.3	57.4½	58.6	59.7½
S...	50.0	51.3	52.6	50.2	51.4	52.6	53.8	54.10	56.0	57 2	58 4	59.6	60.8	61.10
M..	51 8	52.11½	54.3	51.11½	53.2	54.4½	55.7	56.9½	58.0	59.2½	60.5	61.7½	62.10	64.0½